CATALOG OF THE "ANTI-PLUVIUS" PUTTYLESS SKYLIGHT & THE "STRAIGHT-PUSH" "LOVELL" AND OTHER SASH OPERATORS

PUBLISHED BY THE G. DROUVÉ CO., BRIDGEPORT, CONNECTICUT, U. S. A.

ABUNDANT LIGHT — ADEQUATE VENTILATION
Interior Packard Motor Car Co. Building, Detroit, Mich.

ALBERT KAHN, Architect
ERNEST WILBY, Associate

ANTI-PLUVIUS
(Trade Mark)
Puttyless Skylights
(PATENTED)

Lets in the Light
Keeps Out the Weather

DROUVÉ
"STRAIGHT-PUSH"
AND "LOVELL"
SASH OPERATORS
(PATENTED)

Reliable and Easy Control of Sash in Lines of 100, 150, 200 or more Linear Feet

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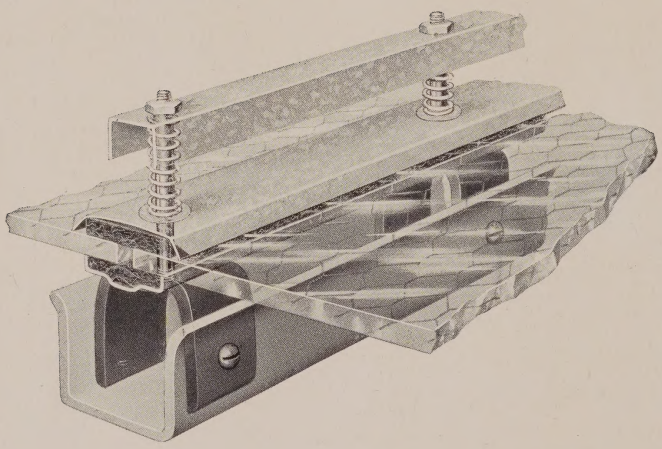
BRIDGEPORT, CONN., U. S. A.

ANTI-PLUVIUS
(Trade Mark)
Puttyless Skylights



ANTI-PLUVIUS
(Trade Mark)
Puttyless Skylights

INTRODUCTORY

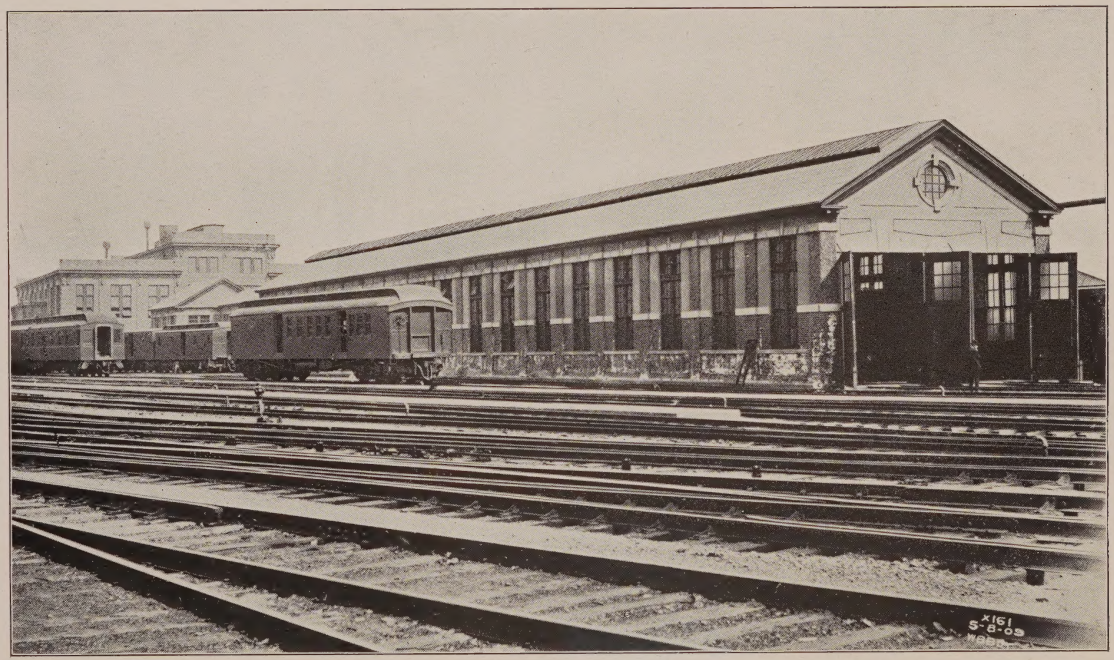
IN presenting this catalogue to the architect or contractor, manager or owner of large buildings, we aim to show that a standard has been reached which insures results of a high order and that the material is adjustable to varying conditions at a price within the limits of economy.

The catalogue is devoted to a detailed explanation of the "Anti-Pluvius" system of skylighting in its adopted form to conditions in this country. Also the various types of sash operators for industrial and general uses. The "Straight-Push" Sash Operator is particularly covered as it embodies the very latest improvements based on a large experience under service conditions with many types.

Attention is called to the methods of supporting skylights, the fastening of framework to curbs, and the spacing of channels. These and other features are covered in the specification form on page 45, and for the operator page 68.

THE G. DROUVÉ COMPANY

Bridgeport, Connecticut



"ANTI-PLUVIUS" PUTTYLESS SKYLIGHT, DOUBLE PITCH TYPE

250 Feet Long on the Ridge. Coach Shop, D. L. & W. R. R. Co., Hoboken, N. J.

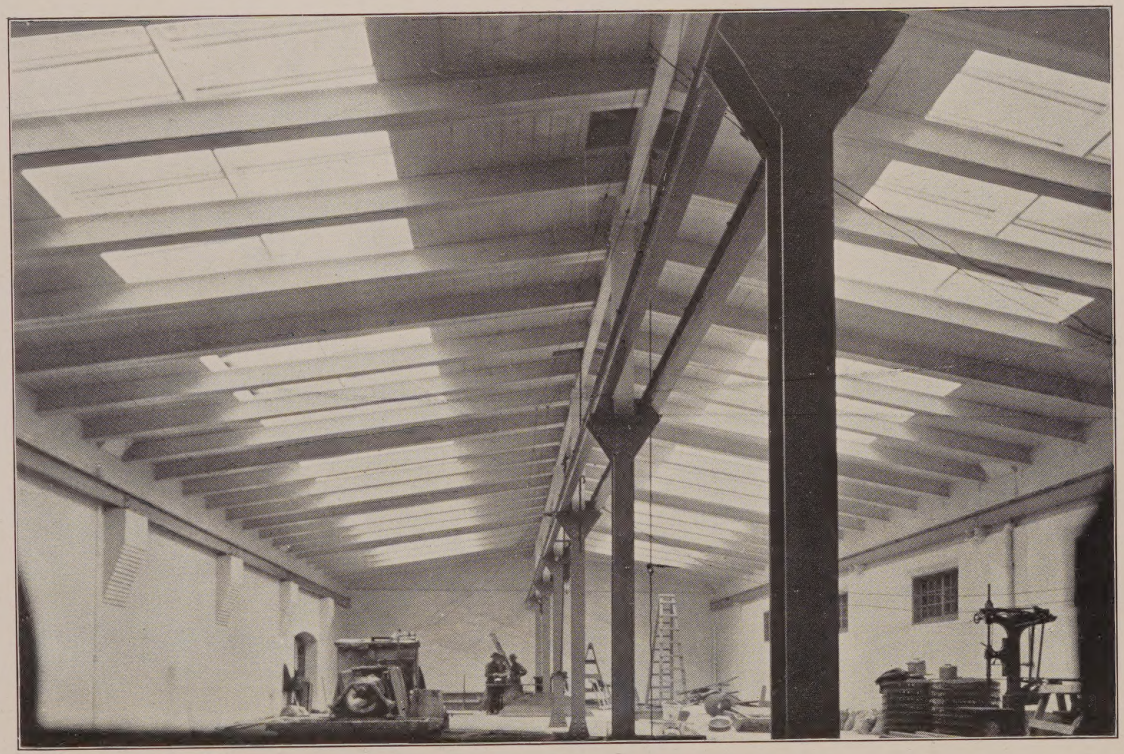
The Relation of Daylight and Ventilation to Industrial Efficiency

Light to work by, and sufficient light to work well by, is one of the fundamental requirements of industrial efficiency. Good air, which can be secured only by adequate and constant ventilation is another. A glance at the older factories shows fairly well that this fundamental idea did not get a very strong lodgment in the economic consciousness of our great-grandfathers. The old factories of New England, for instance, are notable for nothing more than their very scanty window space and inefficient ventilation.

But conditions have improved, and the very modern study of the operative himself as a machine, and the attempts to discover under what conditions this human machine can do his best, have led within a few years to a revolution in shop lighting.

No one needs to be told that daylight is the best light to work by. There are also other reasons for using daylight where such use is possible. Artificial light, to begin with, costs money, while daylight does not. Moreover, it is a difficult matter to apply artificial light so that it shall enable the operator to do his work well, and to escape damage to himself by overstrain upon his eyes. Daylight, supplied from roof and side windows is intense, yet so diffused that it does not give the dense shadows that are the gravest difficulty with artificial light.

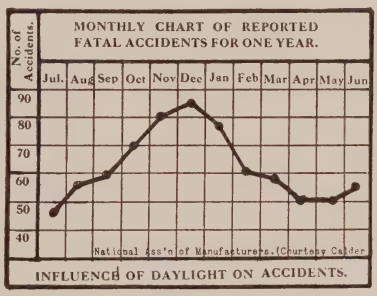
Adequate, agreeable light to work by has been shown to have a great effect on the output of work. For instance, the owner of a large plant for automobile repairs has declared that his men can do various typical jobs of



"SUFFICIENT LIGHT TO WORK BY"
York Manufacturing Co., York, Pa.

repairs in half the time out of doors that they require inside the shops. Such a result of daylight working represents many single elements compounded into the final result. One element is the greater cheerfulness with which every man works when he can have daylight. Another element is the absence of undue eyestrain, and the consequent avoidance of a host of subsidiary small discomforts that follow fatigue and which subtly but markedly lessen the efficiency of the worker. These are the gross factors, which the intelligent observer, though untrained in such study, may rather easily discover for himself.

The effect of daylight as an aid to workmen in avoiding accident is shown by the investigation into the causes of accidents and the seasons in which they occur, as carried out by a special committee of the National Association of Manufacturers. The resulting statistics show that fatal accidents invariably occur less frequently in those months when daylight is most abundant, and offer an excellent argument in favor of increased skylight and sidelight areas.



It has been left for "motion study" and "time study" applied to the elements of industrial processes, to prove the great ultimate financial saving that accrues from the minute savings of time that are made possible by adequate daylight illumination. Half a minute saved by day-light lighting on an operation consuming, say, a quarter of an hour, may seem so small as to be negligible.

"ANTI-PLUVIUS" PUTTYLESS SAW-TOOTH SKYLIGHTS
Baird Machine Company, Bridgeport Conn.

FLETCHER ENGINEERING CO
Engineers and Designers

But when that half minute is accompanied by other half minutes saved on other operations, and the total time savings per year on many thousand repetitions of all these processes are computed, the ultimate saving in dollars is astonishingly large.

Good ventilation is another condition of human efficiency that is now receiving a beginning of the consideration that it deserves. Mechanical ventilating systems are of course necessary under many conditions, but the possibilities of inexpensive efficiency in simultaneous lighting and ventilating by means of windows and monitor skylights have as yet hardly been touched. Monitor ventilators in roofs have been largely used, and window space in walls has been greatly increased, with consequent better lighting. But not until within a few years has there been a type of skylight that would satisfy the exacting requirements of stiffness under wind and snow loads, of perfect water-tightness, of freedom from condensation drip, and of endurance against corrosion. And it is only lately that the opening of side or monitor windows for ventilation purposes has been reduced to every-day, unfailing efficiency.

Economical daylighting and window ventilation impose certain conditions. Skylights for public and private buildings should be water-tight, of a permanent character, and not subject to continual repairs and early renewal. The glass area should be sufficient to allow the passage of the desired amount of light. Proper curbs and supports with necessary pitch to take care of the condensation should be provided and suited to the roof construction and conditions. Strength of materials and of the structure is essential to withstand wind-pressures, snow-loads, atmospheric conditions and the

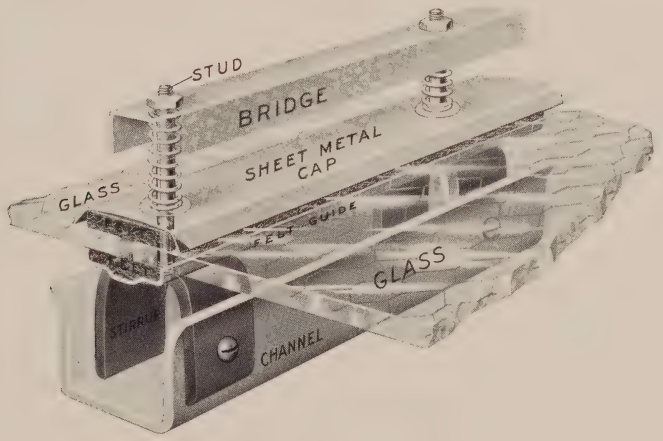
weight of a man or men without danger to the individual or to the glass. There should be provision for cleaning the glass and giving the proper maintenance to the structure in accordance with time's demand. Flexibility is as important as contraction and expansion; vibration and wind-pressures must be considered so that neither glass nor the construction as a whole will be endangered. Sufficient supports are essential to properly secure the skylight frame. The construction should permit of the quick removal of a light of glass by a man about the place. It must be adapted to all types of roofs,—wood, metal, brick, tile, and concrete construction. It must be simple so that it can be installed by unskilled labor. In regard to ventilation, windows, and especially long rows of windows, must be capable of being opened and closed mechanically in long sections and with absolute certainty of action.

Imperfect skylights are a source of the greatest annoyance, damage, and expense. The closing up of leaks in imperfect skylights is difficult as the thoroughness of the caulking cannot be tested except by another rain storm or a load of melting snow. Such difficulties as these are especially likely to occur on roof lights with a low pitch. The use of tried and tested designs of skylights is no more than prudent insurance, and in the long run is the best economy.

These two supremely important matters,—ample daylighting through skylights, and easy dependable manipulation of long rows of windows for ventilation—have now been put within reach of the architect, engineer, and manufacturer in the shape of the "Anti-Pluvius" Puttyless Skylight; and the "Straight-Push" and "Lovell" Sash Operators.

ANTI-PLUVIUS
(Trade Mark)
Puttyless Skylights
(PATENTED)

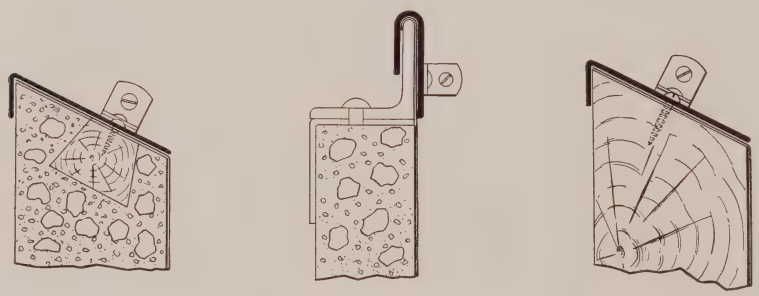
The "Anti-Pluvius" system of Puttyless Skylighting is an evolution; it combines the best that foreign practice has developed and American experience has taught. The design was perfected by men having long practical training in skylight construction and manufacture, and with proper considerations for climatic and building conditions. Its details, which have been modified progressively, embody now every real improvement, whether suggested by failure or approved by success.



The "Anti-Pluvius" design provides a framework built up of special rolled steel channels for carrying the glass. This framework is made water tight and weatherproof, without the use of putty, cement, or solder. The bridge feature permits ready access to all parts of the skylight and is a distinct advance over any other skylight construction, making possible larger glass areas than before.

"ANTI-PLUVIUS" PUTTYLESS SKYLIGHTS

There is no longer any reason why skylights should be a source of annoyance and expense or left out of plans because of past unfortunate experiences, for with the "Anti-Pluvius" construction, skylights of any size or type always give satisfactory results. Nor is it in the interest of good building construction to continue the use of an old specification which allows the introduction of cheap skylight construction and poor workmanship. Good materials and workmanship are essential, and a rolled steel section with the glass so placed as to be free from damage due to expansion, contraction, or movement of any kind, presents a service and economy impossible with any other form of construction. How the "Anti-Pluvius" design works out this combination is shown in the accompanying illustration which gives the cross section of the glass and supporting channel.

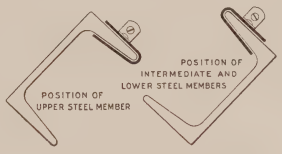


Various Adaptations of Drouvé Patented Continuous Clips

The superiority of the "Anti-Pluvius" system of skylighting and the advantages of this construction are apparent from a study of the illustration. Perhaps the best way to point out the advantages is to explain the method of building up the skylight.

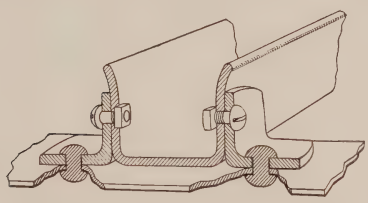
With an opening in the roof having the curbs and intermediate supports in place and the curbs so flashed by

the roofer that the connection of the roof and skylight will be tight, the Drouvé patented clip is then applied. The continuous clip is made in uniform sections for ease in handling and when placed on the respective curbs for which they are arranged they are ready for securing the channels which are bolted to the angles or lugs.

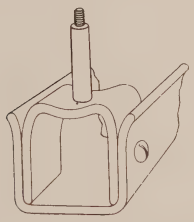


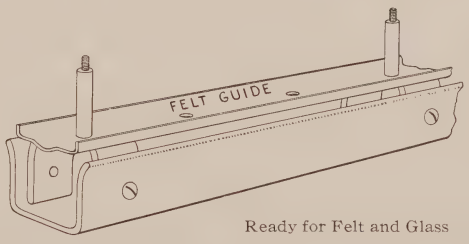
Continuous Clip Applied to Steel Members

To obtain a uniform spacing of the channels, which good practice has set at 18⅝ inches on centers, small angles are riveted to the continuous clip, two for each channel. The channel sets between the angles or lugs insuring a fixed and rigid support. When all the channels are in place, the whole skylight opening is covered with a complete framework made up of units.


Lug Riveted to Continuous Clip—
Skylight Channel Bolted Thereto

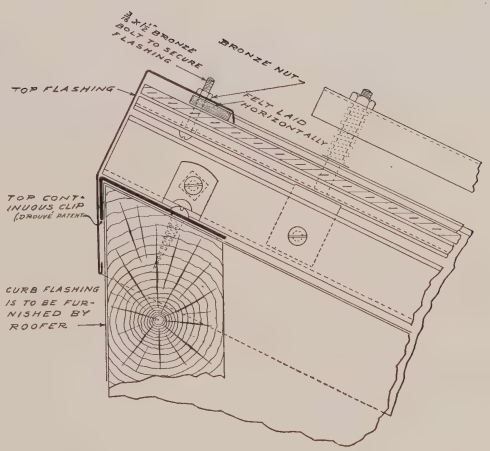
Steel stirrups with ⅜ inch Tobin bronze studs screwed therein are then placed in the channels approximately 16 to 20 inches apart. These stirrups are then secured

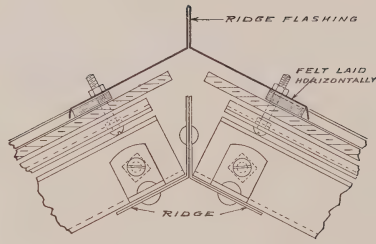

Stirrup Set into Channel

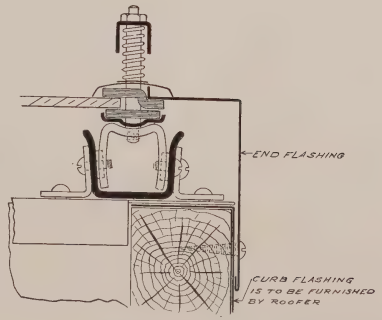


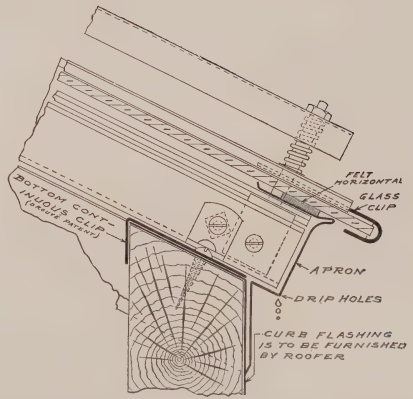
Ready for Felt and Glass

in place by machine screws and over the studs are placed the felt guide and the strip of cowhair felt.


3/8"x1½" BRONZE BOLT TO SECURE FLASHING
BRONZE NUT
TOP FLASHING
FELT LAID HORIZONTALLY
TOP CONTINUOUS CLIP (BRONZE METAL)
CURB FLASHING IS TO BE FURNISHED BY ROOFER







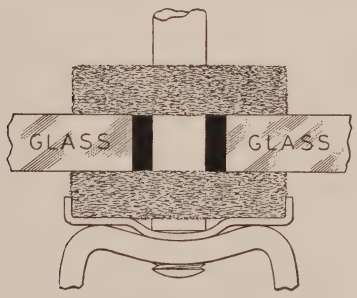
TYPES OF FLASHINGS FOR "ANTI-PLUVIUS" PUTTYLESS SKYLIGHTS

Both the felt guide, which is made of "Toncan" or other rust-resisting metal, and the cowhair felt, a non-rotting material, are punched at frequent intervals, which permit them to slip readily over the studs secured in the stirrups. This gives a fixed position to the felt guide and cushion.

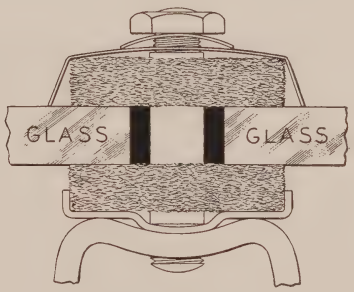
The glass, which has been cut to size is then put in place. It has a cushion bearing on the felt at the two sides and also at the top and bottom. Another strip of cowhair felt is then placed over the studs and the sheet metal cap, turned down at the sides, is placed over the felt with a pin point touch on the glass. This metal cap

Non-Rotting Felt—Note Frequent Punching

entirely encloses the strip of cowhair felt. The glass is now embedded between two cushions of felt, which conform to the uneven surface of the glass and make a tight and elastic joint without the use of putty or cement.

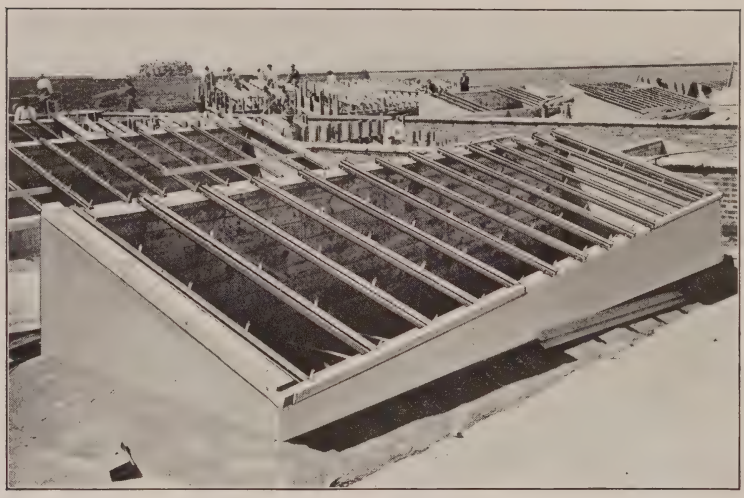


Glass Well Bedded Insuring Flexibility

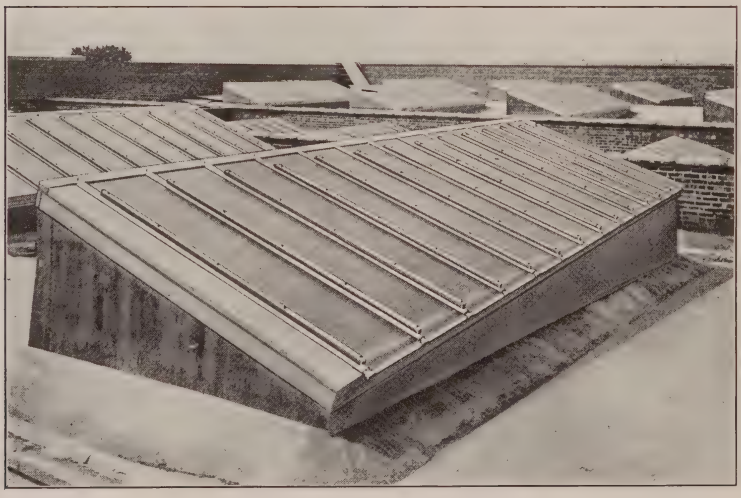


Cap Protecting Top Felt Strip
Finish—Sawtooth Type

For sawtooth roof construction a shorter stud of the same diameter is used and the metal cap placed over the upper strip of cowhair, is held in place

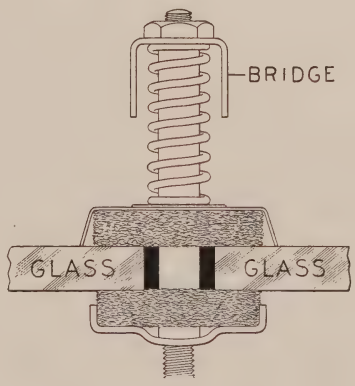


In Process of Erection
"ANTI-PLUVIUS" PUTTYLESS SKYLIGHTS, FLAT TYPE
on Oneida Railway Company, Syracuse, N. Y. Wolf Street Shops



Completed
"ANTI-PLUVIUS" PUTTYLESS SKYLIGHTS, FLAT TYPE
On Oneida Railway Company, Syracuse, N. Y. Wolf Street Shops

by a nut. With double pitch, flat or hipped skylights the stud projects one and three-quarters inches above the outside, and carries a phosphor bronze coil spring which is set in tension by placing an inverted channel, known as the "bridge" over the studs. At the upper end of the stud a shoulder supports the bridge. The nuts are then secured and any weight placed on the bridge is carried through the studs into the supporting channel beneath without contact with or pressure on the glass. This bridge provides ready access to the skylight surface for cleaning, repainting or repairs. The easy removal of the nuts holding the glass in place, makes the replacements simple and economical when necessary, and easily within the ability of ordinary workmen. The top and bottom flashing, known as an apron, is placed over the phosphor bronze studs provided at each rib. These flashings, together with the side and end flashing which is placed under the sheet metal cap, close in the skylight on all sides and cap flash, as well, the roofers flashing of the curbs.

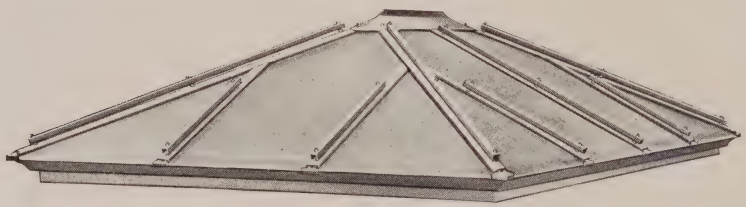


Spring Takes Up Vibration and Draft Pressure From Beneath

Weight Carried Through Shoulder of Stud to Channel Below Glass—No Contact or Pressure on Glass

EACH GLASS INDEPENDENT

The lights of glass do not come in contact with each other, nor do they touch the channel, therefore, no sweating of the steel member can occur through chill conveyed from the cold glass. The glass being raised above the channel permits the same atmospheric conditions to surround the steel members. This design practically elim-



"ANTI-PLUVIUS" PUTTYLESS TYPE SKYLIGHT

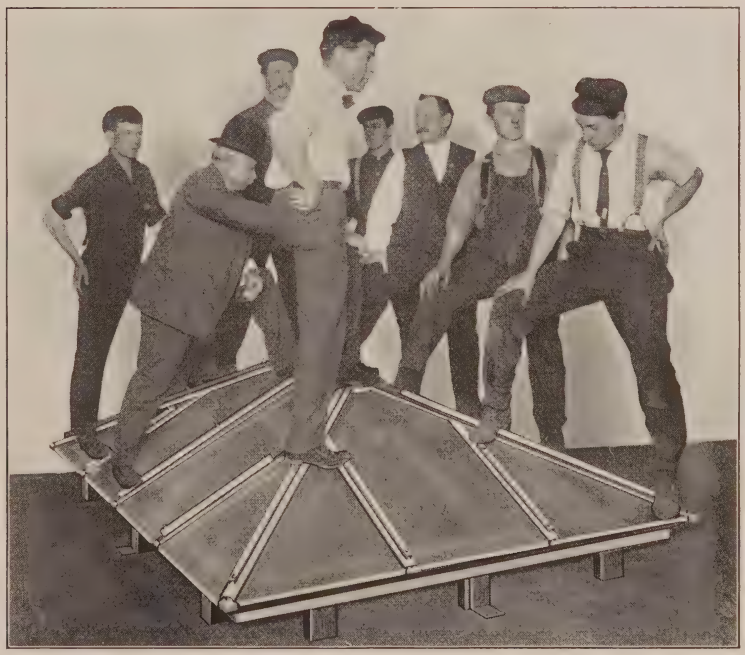
inates glass crackage, due to difference in temperature between glass and metal, one having an outside exposure and the other being heated from the interior. In this manner the "Anti-Pluvius" construction overcomes the serious objection to the usual forms of skylight.

The condensation on the under side of the glass can be taken care of only when the skylight has proper pitch. The method of disposing of the condensation after it has traveled the length of the glass has been an almost insurmountable obstacle. Formed gutters have been a source of much trouble where the lights of glass join or butt. This difficulty is avoided in the "Anti-Pluvius" design by lapping the glass and utilizing a portion of the lower light, which in its natural position acts as a gutter. This is accomplished by a series of graduated stirrups numbered one to five, placed in the channels so that each light of glass is elevated just above the lower one, allowing for an overlap. The opening between the

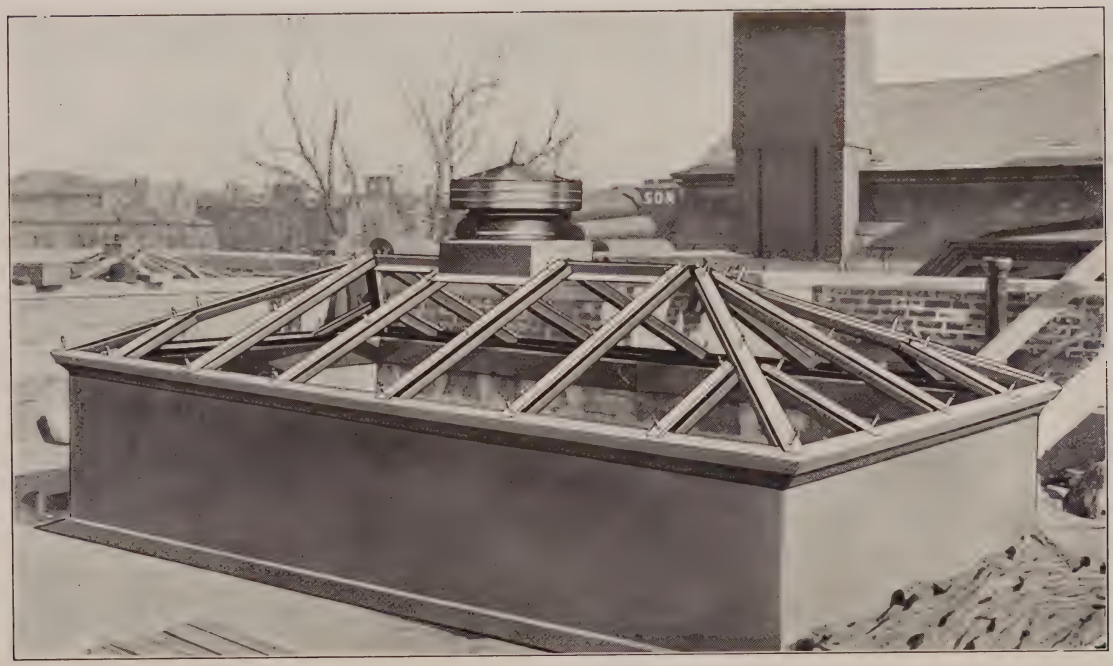
glass is closed by a strip of cowhair felt placed horizontally. The space provides a natural gutter for taking from the upper light the condensation which finds its way into the lipped channel at either side in its natural course, or is absorbed and filtered through the felt strip. The channels convey any condensation through the proper outlets to the roof.

STRENGTH

Abundant strength to meet practically any condition of wind pressure, snow load, weight of men, etc. is apparent. A framework of rolled channel sections provides a construction to resist deterioration. It has been found



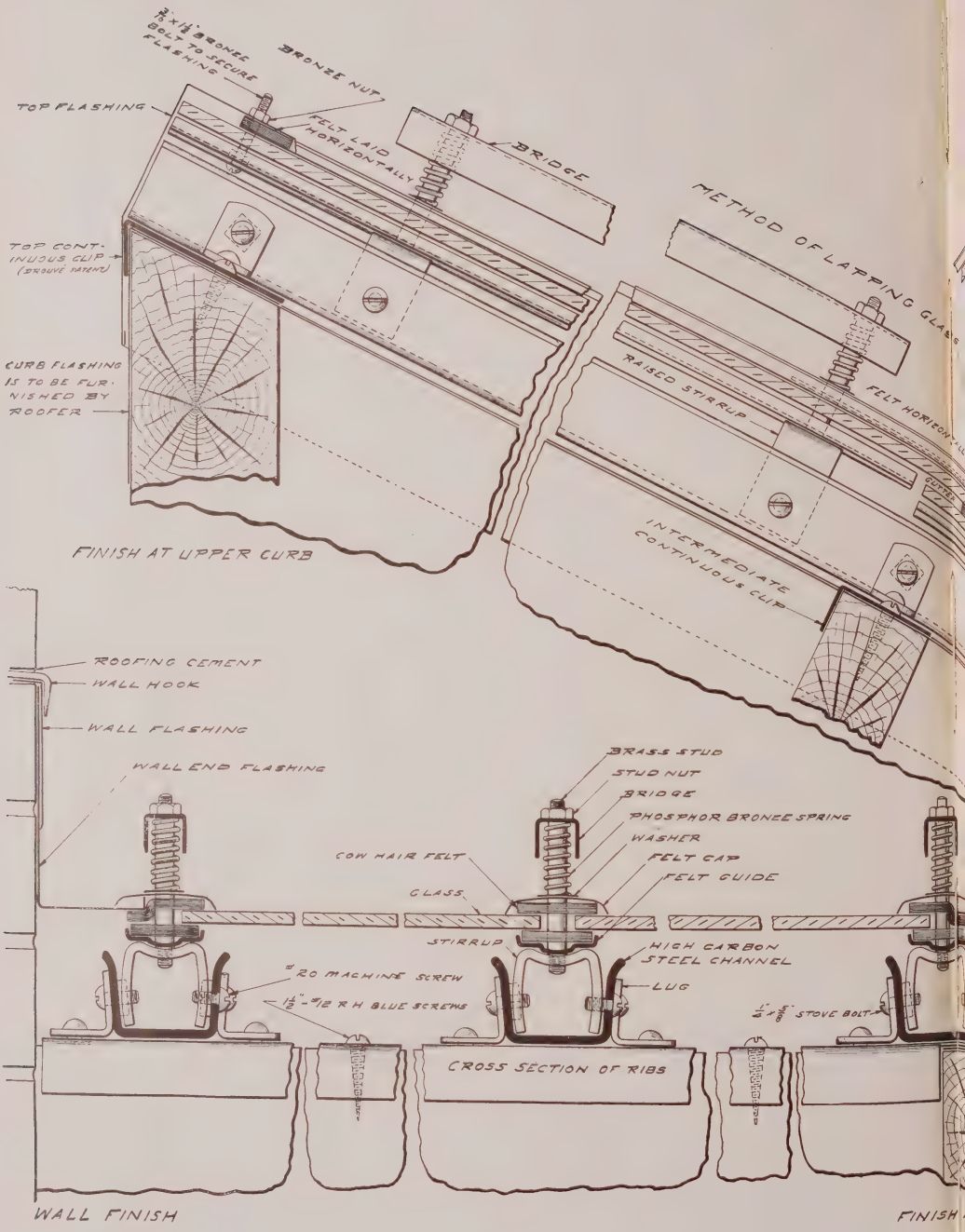
"ABUNDANT STRENGTH"

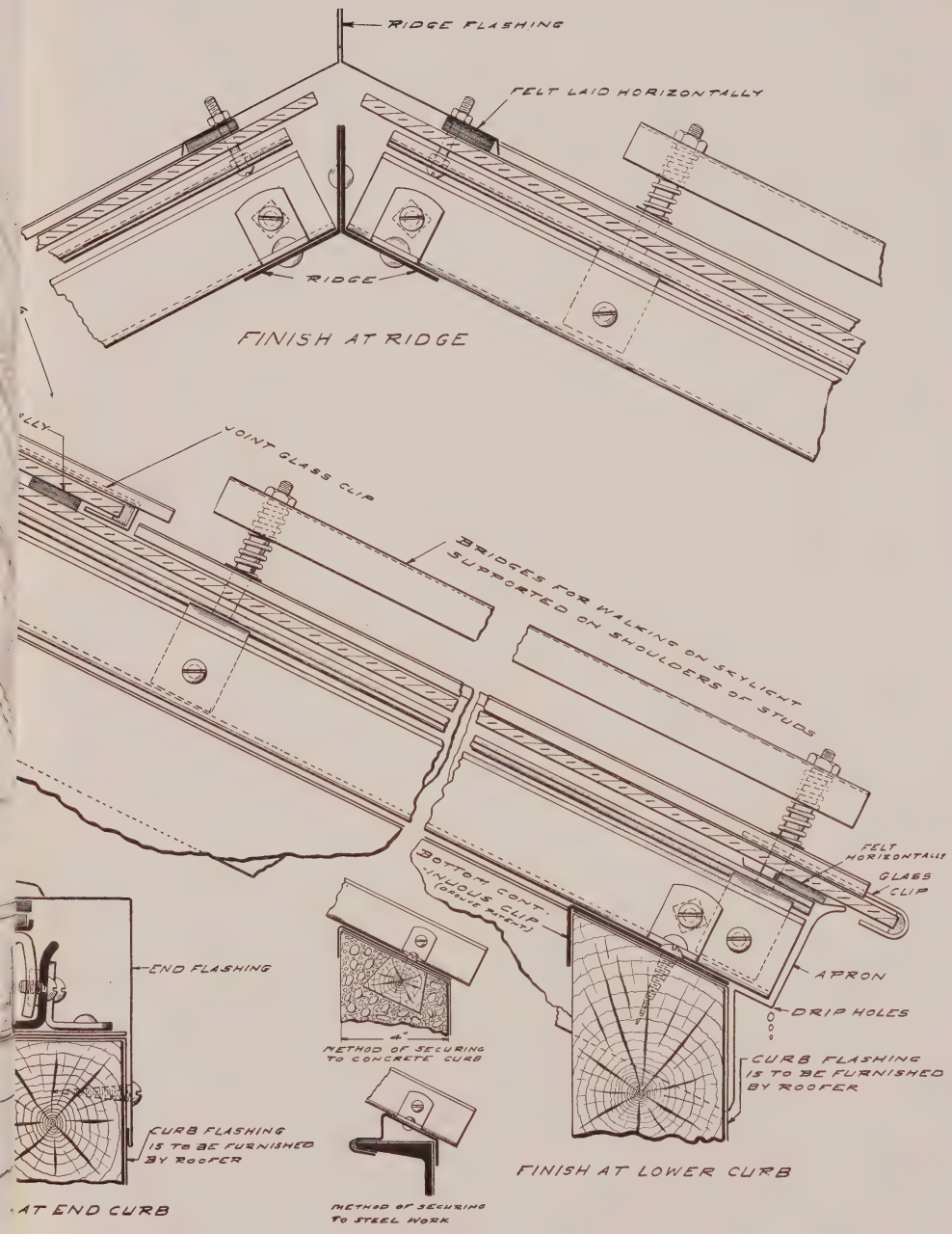


"ANTI-PLUVIUS" PUTTYLESS SKYLIGHT, HIP TYPE WITH ROUND VENTILATOR
In Process of Erection, Peoples Savings Bank

that a skylight of any considerable size should be properly secured in order to prove water-tight and permanent. Supports should be provided in the form of purlins or curbs, about 6 feet apart, this distance being equal to the length of the longest light of glass that practice recommends. Of course, there are times when this spacing is impossible, but the lack of sufficient supports cause frequent and costly repairs. Locking the skylight framework is an important part of skylight construction, and the slight extra cost for the additional steel members (purlins and curbs) is more than offset by the saving in cracked glass and repairs. Inside drafts in large manufacturing buildings are not at all unusual and their hammerlike blows tend to loosen putty or nuts, thus giving opportunity for a general ripping off of the skylight, or the glass or both if not properly secured.

With the "Anti-Pluvius" any upward movement of this kind is taken care of by the phosphor bronze springs and cowhair felt cushions in which the glass is embedded. An authority ends an article describing skylight installations by saying: "These are two instances of large skylight installations in which both were spoiled—the one slightly and the other radically—solely by insufficient fastenings. Strength of materials is important, but improperly secured, their value is many times diminished."


BRONZE NUT
TOP FLASHING
FELT LAID HORIZONTALLY
BRIDGE
TOP CONTINUOUS CLIP (GROOVE PATENT)
CURB FLASHING IS TO BE FURNISHED BY ROOFER
METHOD OF LAPPING GLASS
RAISED STIRRUP
FELT HORIZONTAL
INTERMEDIATE CONTINUOUS CLIP
FINISH AT UPPER CURB
ROOFING CEMENT
WALL HOOK
WALL FLASHING
WALL END FLASHING
BRASS STUD
STUD NUT
BRIDGE
PHOSPHOR BRONZE SPRING
WASHER
FELT CAP
FELT GUIDE
COW HAIR FELT
GLASS
STIRRUP
HIGH CARBON STEEL CHANNEL
LUG
20 MACHINE SCREW
1½" - 12 R H BLUE SCREWS
STOVE BOLT
CROSS SECTION OF RIBS
WALL FINISH


RIDGE FLASHING
FELT LAID HORIZONTALLY
RIDGE
FINISH AT RIDGE
JOINT GLASS CLIP
BRIDGES FOR WALKING ON SKYLIGHT SUPPORTED ON SHOULDERS OF STUDS
FELT HORIZONTALLY
GLASS CLIP
BOTTOM CONTINUOUS CLIP (GRAVITY PATENT)
APRON
DRIP HOLES
CURB FLASHING IS TO BE FURNISHED BY ROOFER
FINISH AT LOWER CURB
METHOD OF SECURING TO CONCRETE CURB
METHOD OF SECURING TO STEEL WORK
END FLASHING
CURB FLASHING IS TO BE FURNISHED BY ROOFER
AT END CURB

"ANTI-PLUVIUS" PUTTYLESS SKYLIGHT
Packard Motor Car Co., Detroit, Mich.

ALBERT KAHN, Architect
ERNEST WILBY, Associate

GLASS SIZES

Good practice recommends glass lights 6 feet or less in length, by 18 to 20 inches in width, particularly wired glass. A standard of 18 inches width of glass with $\frac{5}{8}$ inch distance between lights is maintained if possible with "Anti-Pluvius" construction. Relatively narrow ribs offer the least possible obstruction to the passage of light, and the glass is effective over practically its entire area. The advantages of using the standard sizes are obvious, although the ribs may be readily spaced for other widths when desired. About 87 percent of the glass area is available for the passage of light.

WEATHERPROOF

Probably the most striking, and without doubt the most valuable, feature of this skylight design is characterized by the trade name "Anti-Pluvius," which means "against rain." This idea is literally carried out wherever "Anti-Pluvius" installations are found. Weatherproofness is assured under all conditions of temperature and climate. This is due, of course, to the design and elimination of putty or cement as a binder. The cowhair felt cushion and spiral springs take care of all expansion and contraction, all vibration, all unevenness in glass, and all inside draft pressure. The continuous clips lock the skylight framework to its supports, making it practically impossible for the wind to blow it off or even loosen it.

PUTTYLESS

Too great stress cannot be laid upon this feature, which with the bridge permits ready access to the sky-

"ANTI-PLUVIUS" PUTTYLESS SKYLIGHT, DOUBLE PITCH TYPE—HIPPED ENDS, RIDGE VENTILATORS

Boston Elevated Railway Co. Power Station, So. Boston

STONE & WEBSTER CORP., Engineers

light glass and framework. This is sometimes necessary for cleaning the glass, repainting the channels, or minor repairs. Neither cement nor solder is used, nor any perishable material which is liable to dry out and crumble. The glass is well embedded between the cowhair felt strips, and should any water find its way inside it would necessarily be absorbed in these strips. The channel is lipped to take any drippage that might possibly occur, and carry it to the roof outlets. Samples of cowhair felt that have been in service from five to ten years show no signs of deterioration. With these cowhair felt cushions the joints with the glass are tighter than is possible with metallic or other hard substances, and the placing of the strips over the studs instead of merely laying them along the sides, holds them in place without being dependent upon pressure. The element of skill is entirely eliminated in the placing and holding of these strips.

CONDENSATION

One of the most serious problems confronting factory and mill architects is the disposal of condensation on skylights particularly the sawtooth type. Much attention has been given to this matter and many schemes have been devised to care for condensation especially in winter when the outside freezes up solid and there is no outlet for draining. Gutters have been arranged inside the building; but these have proved inadequate, and dust and dirt accumulating in the gutters have blocked up the outlets.

The "Anti-Pluvius" sawtooth arrangement has provided for this as shown in the illustration. The deep pockets hold a large amount of condensation with-

out letting it get into the building. With the continuous opening and the occasional weakening of the ice binder, helped by the high temperature existing at the top of a heated building, the accumulated condensation finds access to the outside. No sweating of the steel members occurs, for at no point does the glass come in contact with the metal.

With types of "Anti-Pluvius" skylights other than the sawtooth, moisture formed on the skylight glass is taken care of by a pitch of not less than 4 inches to a foot, which carries the condensation down the glass to the natural gutters provided, as already explained. These in turn drain into channels which have outlets on the roof. The channels are carried over the curb so that in freezing time any backing up of accumulated condensation has a drop along the apron or flashing, and considerable gutter space must be filled before water can get inside.

Ruined machinery and stock, as well as annoyance to workmen, follow the dripping of water at irregular intervals. It is safer and better to increase the pitch of the skylight than to take chances of loss or inconvenience. The general feature for guidance should be the temperature expected within the building, taking all working conditions into account.

MATERIALS

In the construction of the "Anti-Pluvius" skylight only the very best materials are used. All structural parts have a much longer life than any sheet metal or wood; felt guides, caps, bridges, studs, bolts, etc., are rust-resisting, and the cushions are of non-rotting material. All steel work is easily accessible for repainting

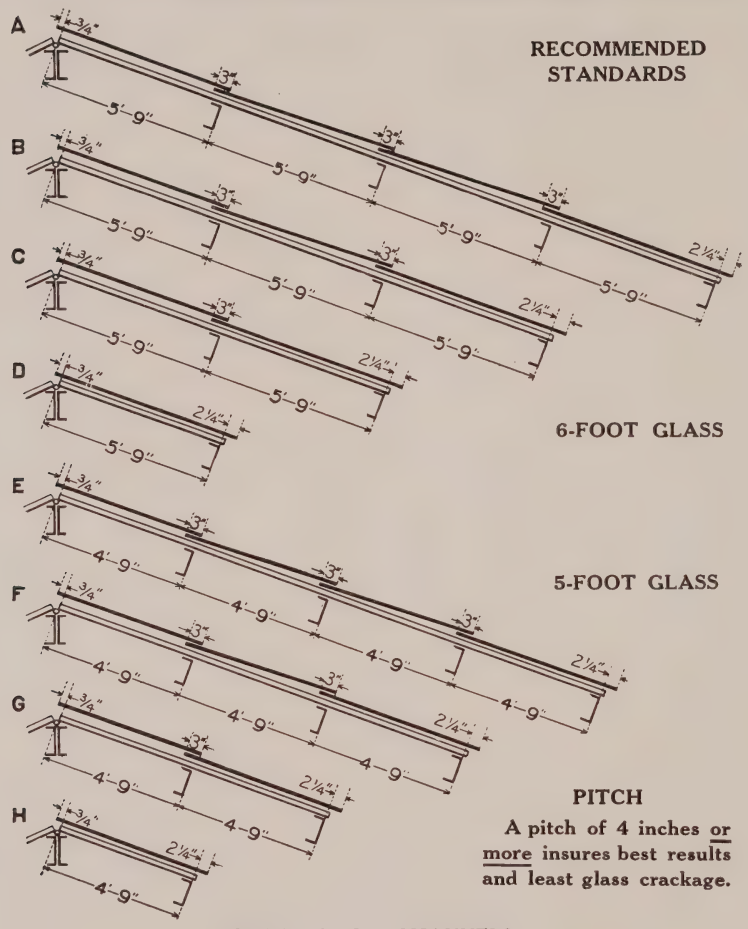
when time demands it. The outside trimmings, such as metal caps and flashings, may be of copper or iron. These trimmings are merely protective in their duty and no serious consequences would result by their giving out. Renewals are unnecessary with a reasonable care for maintenance, and the maintenance charge should be very small compared to the initial cost, so small that it would hardly be worth serious consideration. The entire structure is designed for permanency and economy in maintenance.

SKILLED AND UNSKILLED FACTOR

The almost entire elimination of skill as a factor in the construction of "Anti-Pluvius" skylights, makes possible their erection by almost anyone. Thousands of square feet have been furnished to industrial plants and other buildings, and have been installed by purchasers with uniformly satisfactory results. This points to one of the strongest reasons for the widespread use of "Anti-Pluvius" construction and the cutting down of the repair and renewal bills. The bridge feature permits access to any part of the skylight without danger to the workman and the release of a few nuts makes cleaning or renewal of glass, or repainting of metal, a comparatively simple matter.

GLASS

Of the many kinds of glass used in skylight practice, the rough or ribbed, plain and wired, are the most common. As the name implies, ribbed glass is made with a ribbed surface, the lines running the long way of the glass. These lines have a strong tendency to



RECOMMENDED STANDARDS

6-FOOT GLASS

5-FOOT GLASS

PITCH

A pitch of 4 inches or more insures best results and least glass crackage.

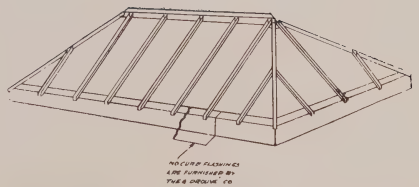
SPACING OF CHANNELS

Purlin supports for 6′ 0″ glass, 4 lights		Purlin supports for 5′ 0″ glass, 3 lights	
Glass overhang at bottom	2¼″	Glass overhang at bottom	2¼″
Glass laps at Joints, 3″ each,	9″	Glass laps at joints, 3″ each,	6″
Glass over reach at ridge	¾″	Glass over reach at ridge	¾″
Total	12″	Total	9″
Total length of 4 lights, 6′ each,	24′	Total length of 3 lights, 5′ each,	15′
Less overhanging	1′	Less overhang	9″
	23′		14′ 3″
Net glass length or spacing of channels 23′ divided by 4 equals	5′ 9″	Net glass length or spacing of channels 14′ 3″ divided by 3 equals	4′ 9″

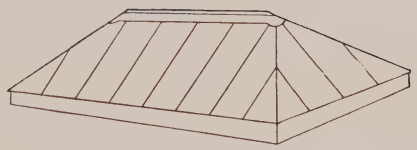
diffuse the light and for this reason this form is used extensively for skylights. It is patterned in accordance with the late Edward Atkinson's specifications for the maximum diffusion of light. The Massachusetts Institute of Technology in a report state, "We may increase the light in a room 30 feet or more deep, to from three to fifteen times its present effect by using factory rib glass instead of plain glass in the high sashes."

Rough glass, sometimes called hammered glass, is semi-transparent and is used where complete vision or decorative effect is not particularly essential. Wire glass has come into general use for skylights, and as produced by many factories, has reached a stage where it is specified extensively for skylight work. Wire glass in sheets no larger than 72″ by 18 to 20″ is the size recommended by authorities. Others recommend smaller sizes; and the recent specifications for the Pennsylvania Terminal in New York City stated that "All glass should be in sheets 20 x 60″. The glass must not bear on the steel." Specifications for the New York City Terminal of the N. Y. C. & H. R. R. R. state that "no glass is to be over 20 x 60 inches."

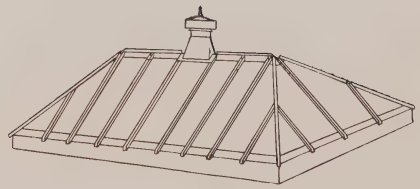
A pitch of not less than 4 inches to the foot assists materially in reducing glass crackage, and there are a number of "Anti-Pluvius" installations where only two or three lights have cracked in three to five years. Wire glass, when broken in skylights, is not so much in danger of falling on the heads of the workmen. It also has the approval of the boards of fire underwriters. Both quarter inch and three-eighths inch glass are used in skylights, but the thickness is a matter of choice on the part of the architect, engineer, or owner.



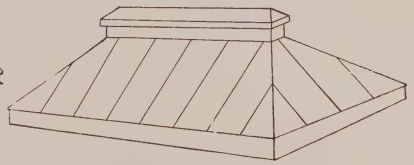
Hipped Skylight Frame without Glass



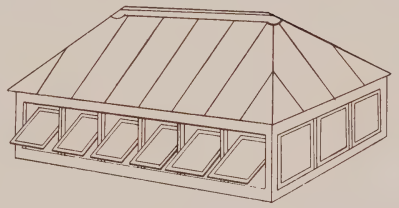
Hipped Skylight Glazed



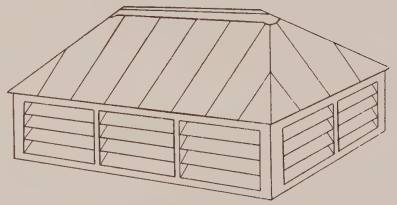
Hipped Skylight with Round Ventilator



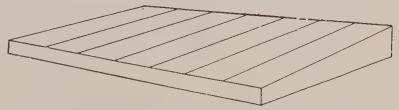
Hipped Skylight with Ridge Ventilator



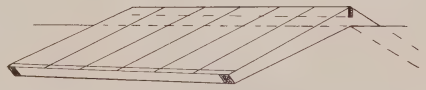
Hipped Skylight with Turret or Monitor



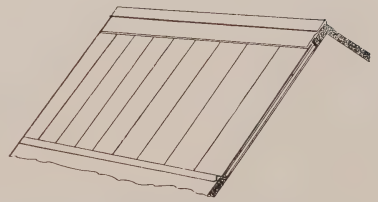
Hipped Skylight with Fixed Louvers



Single Pitch Skylight



Double Pitch Skylight



Saw-Tooth Skylight

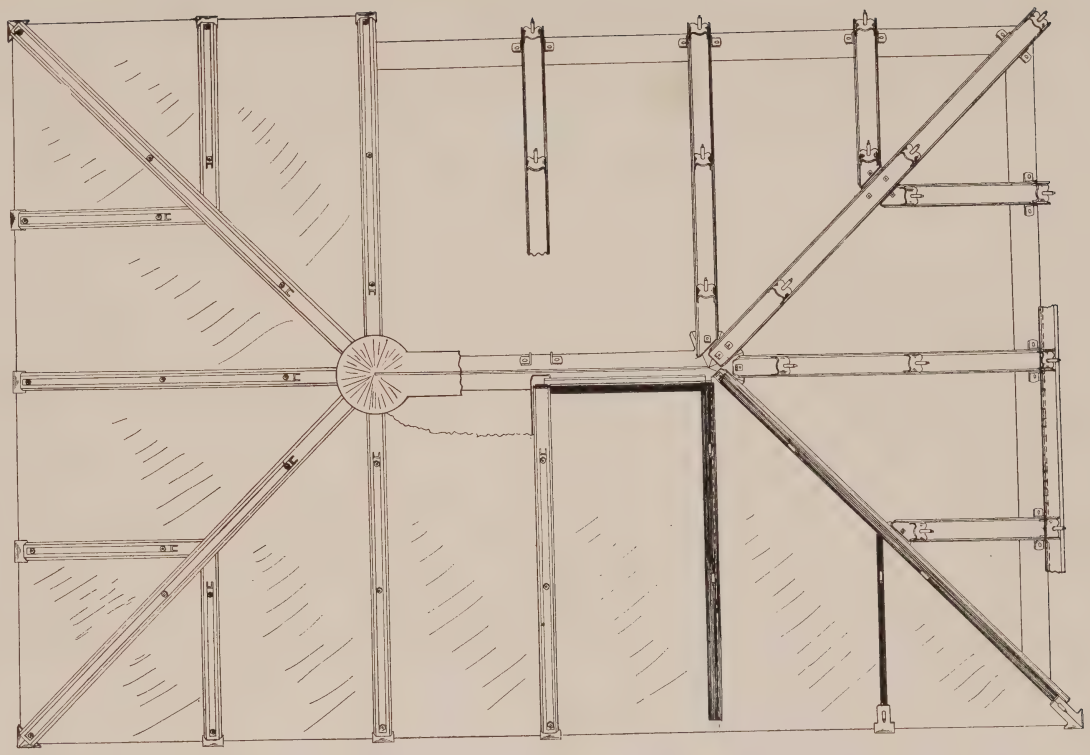
FORMS OF SKYLIGHTS

The illustrations on the opposite page show nine most used forms of skylights, some one of which meets the requirements of all except special construction. In this illustration no attempt has been made to show details—the form merely is indicated. Whatever type the skylight may be, "Anti-Pluvius" construction is used throughout, except where turrets with side sash are shown, in which case this is formed of sheet metal, either copper or galvanized iron. These skylights can be made to cover any size opening. In asking for information, mention the type of skylight required and give the size or sizes and number wanted. State also the trimmings desired. These cover the outside exposed portions of skylight and include caps and flashings and may be of copper, or "Toncan," or other rust-resisting galvanized metal.

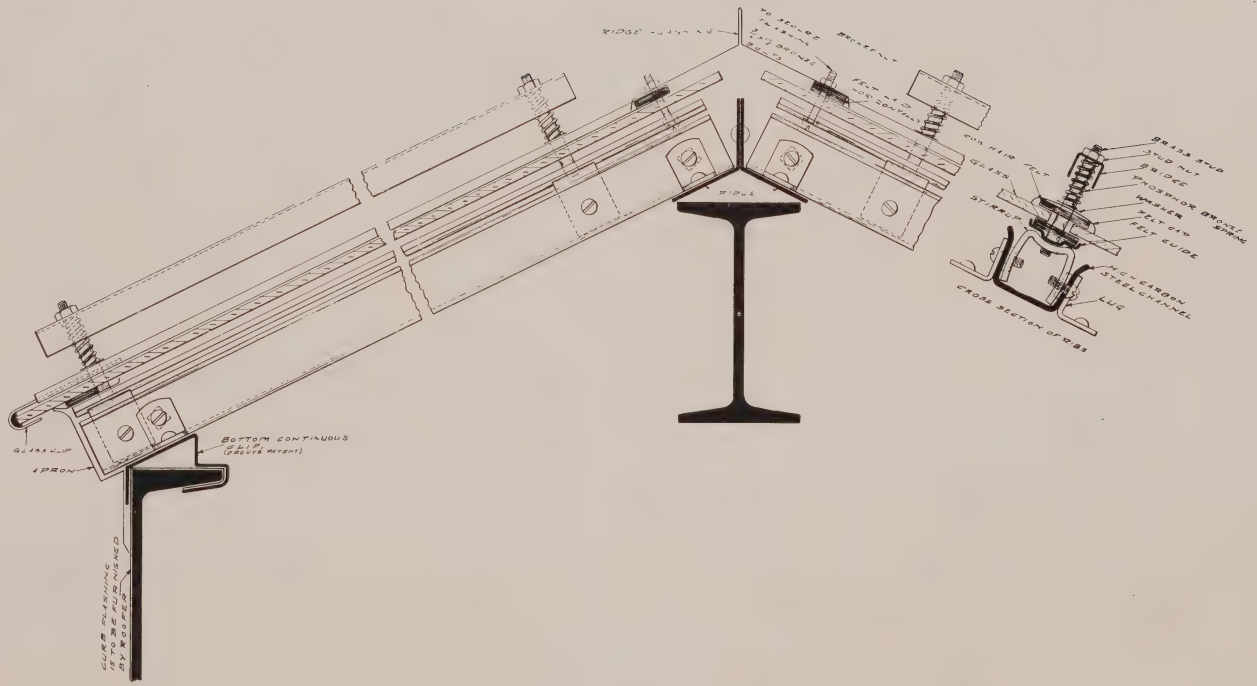
"Anti-Pluvius" skylights can be supplied with rough, hammered, or ribbed, plain, or wired glass. Wire netting can be furnished for use underneath plain glass. Standard practice recommends $\frac{1}{4}$ inch or $\frac{3}{8}$ inch thickness; the $\frac{1}{4}$ inch usually being called for is furnished unless otherwise specified. Steel channels or skylight frame have one shop coat of substantial metal protective paint. Galvanized sheet metal portions are unpainted unless otherwise ordered. These skylights are shipped ready to be assembled at the building, and as no putty or solder is used, can be put together by any person of ordinary intelligence.

"ANTI-PLUVIUS" PUTTYLESS SKYLIGHTS
Hilton Car House, Public Service Railway

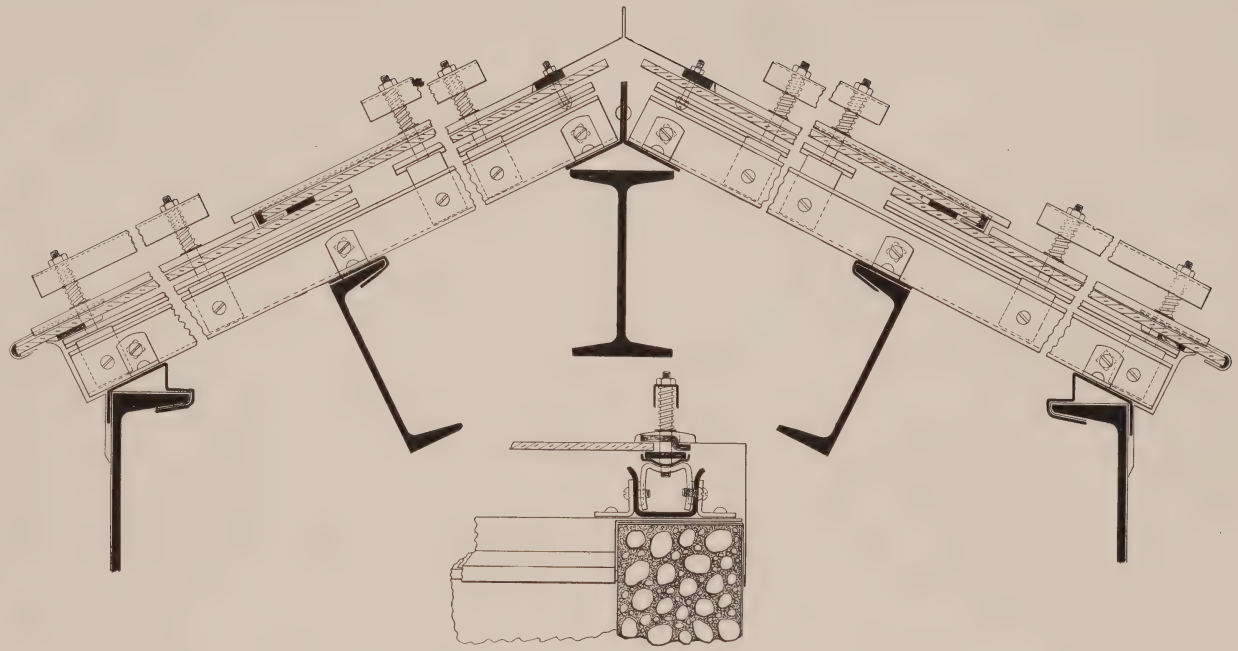
MARTIN SCHRIEBER, JR.
Engr. M. of W.



HIP TYPE OF "ANTI-PLUVIUS" SKYLIGHT IN VARIOUS STAGES OF CONSTRUCTION
Steel Framing Should be Provided for Large Skylights Where Length of Channel on Either Side is Over Six Feet

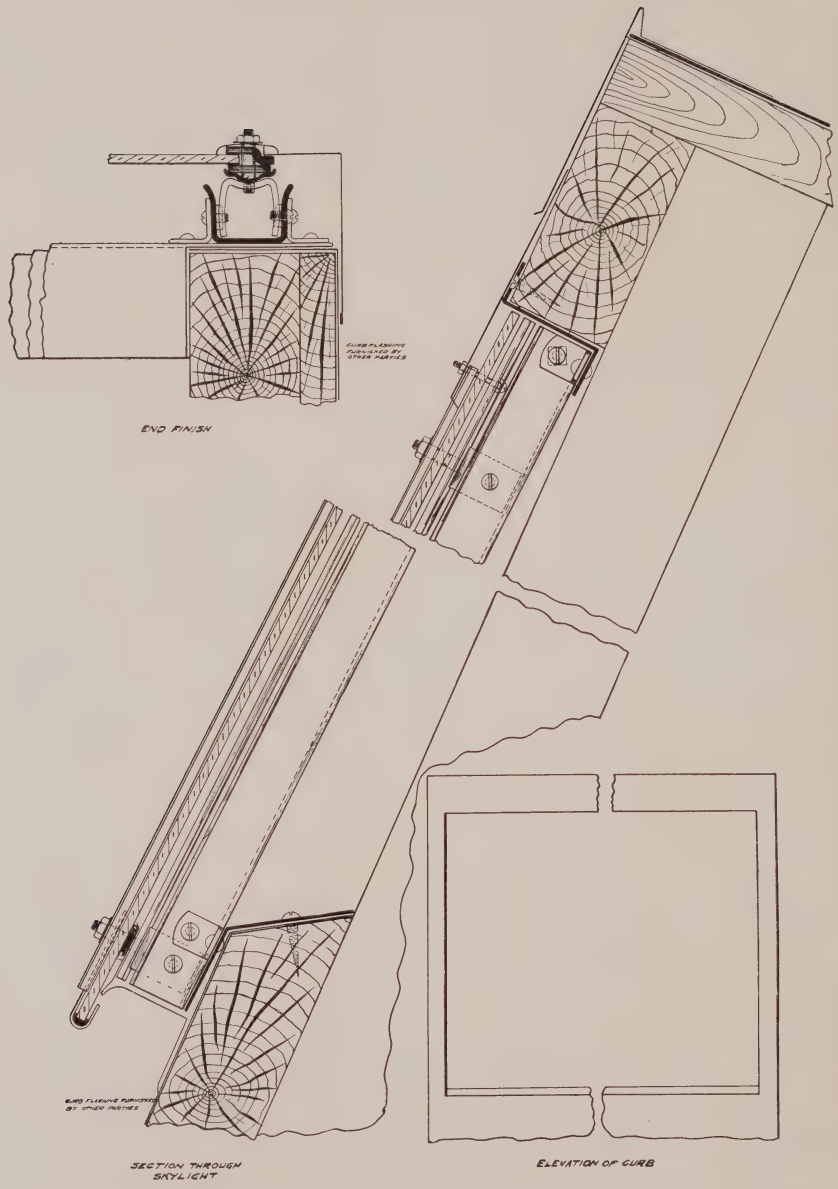


TYPICAL CONSTRUCTION FOR DOUBLE PITCH
Not Over Six Feet Between Supports Insures Best Results

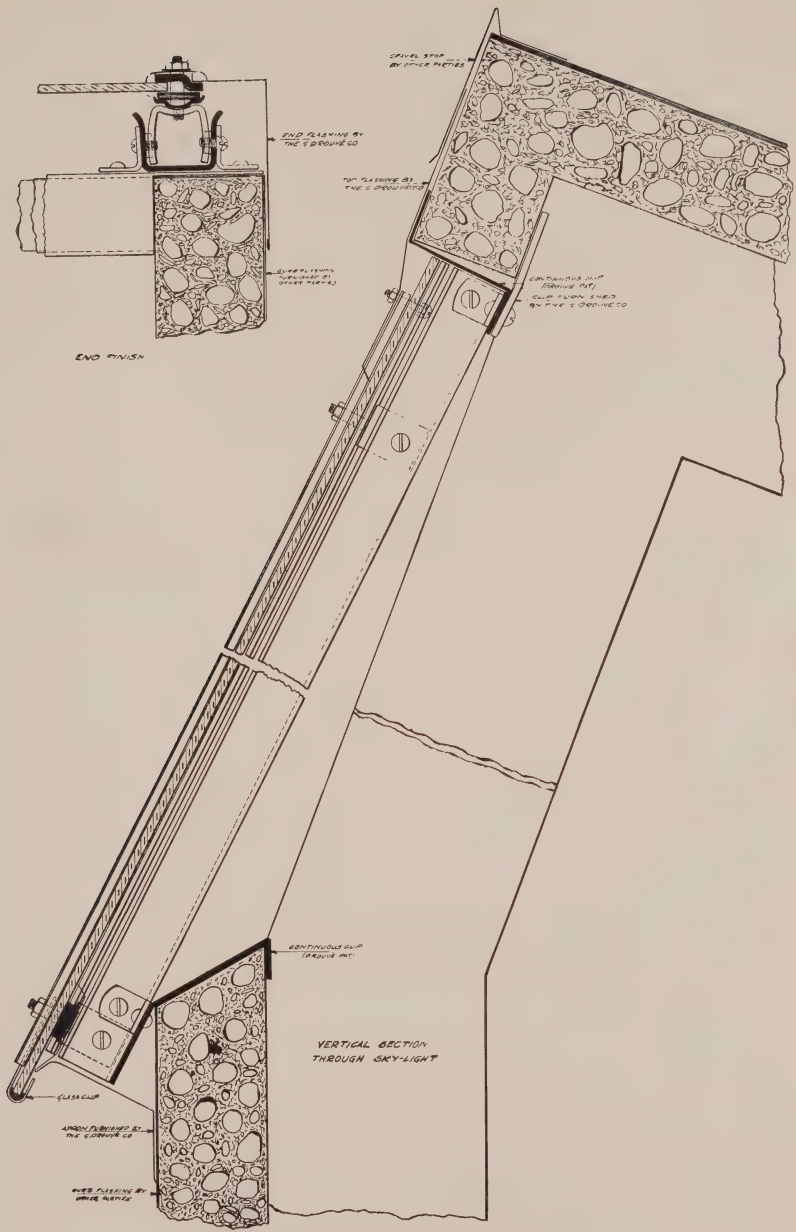


"ANTI-PLUVIUS" DOUBLE PITCH SKYLIGHT CONSTRUCTION

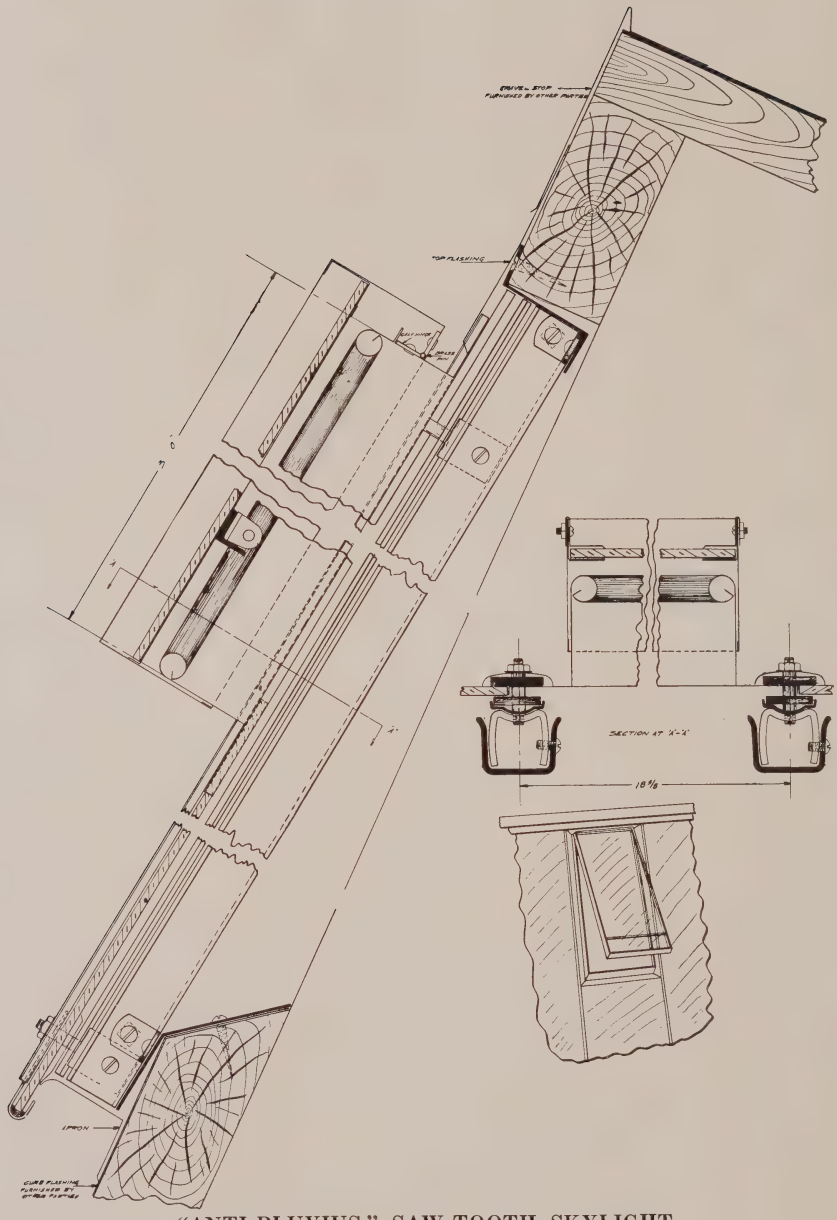
Note Lapping of Glass and Position of Steel Supports. One Every Six Feet Insures Best Results



"ANTI-PLUVIUS" SAW-TOOTH SKYLIGHT
With Wood Curb

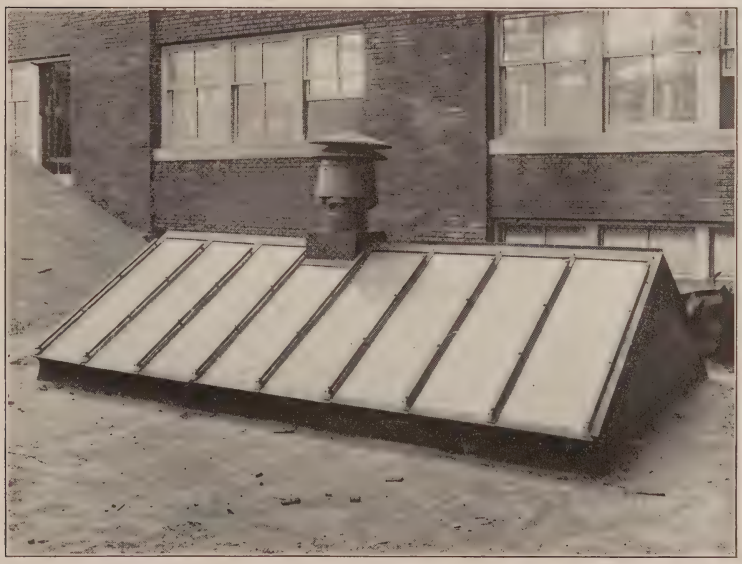


"ANTI-PLUVIUS" SAW-TOOTH SKYLIGHT
With Concrete Curb
41

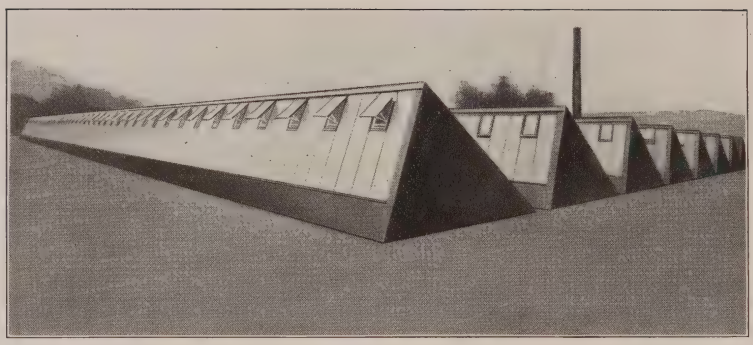


"ANTI-PLUVIUS" SAW-TOOTH SKYLIGHT
With Ventilating Sash

"STRAIGHT-PUSH" SASH OPERATOR
Controlling Ventilating Sashes of "Anti-Pluvius" Ventilating Sawtooth Skylights
West Technical High School, Cleveland, Ohio

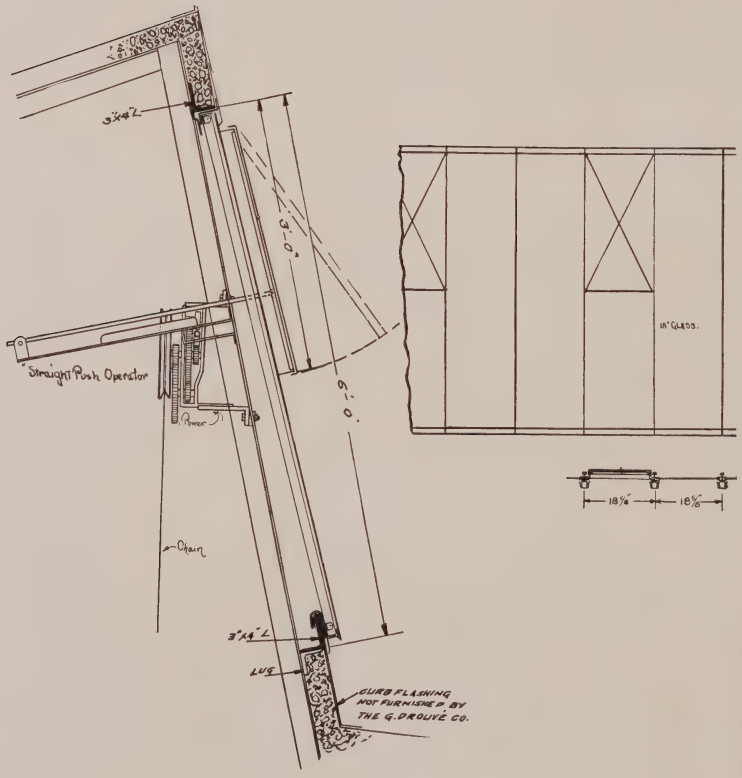


DOUBLE PITCH SKYLIGHT WITH VENTILATOR
West Technical High School, Cleveland, Ohio



"ANTI-PLUVIUS" PUTTYLESS SKYLIGHTS AND "STRAIGHT-PUSH" SASH OPERATOR

Applied to Sawtooth Roof Construction
Blake & Johnson, Waterbury, Conn.



SPECIFICATIONS FOR "ANTI-PLUVIUS" PUTTYLESS SKYLIGHT

Skylights shall be of the "Anti-Pluvius" puttyless type which will allow for expansion, contraction and vibration, manufactured by the G. Drouvé Company, Bridgeport, Conn. The glass shall have a cushion bearing and each light shall be held independent of every other. The glass shall not come in contact with supporting skylight ribs but be held above them to permit uniform circulation of air both inside and outside of the supporting channels or skylight framing. Tobin bronze studs fixed in stirrups shall be provided at proper intervals for carrying guide plate and cushion bearing for glass, these to set over studs and not depend on pressure to hold in place. The projecting necks of studs shall be provided with phosphor bronze springs set in tension by the placing of inverted "U" bars or bridges on the shoulders of studs, and secured with brass nuts.

Supporting channels of skylight frame shall be of rolled steel and securely fastened to lugs provided on continuous clips which shall be furnished for the curbs and intermediate supports where shown.

All caps and flashings above the curb shall be (specify copper, galvanized iron or other material desired).

Glass shall be in sheets not over 18″ x 72″ (specify kind and thickness of glass required). (The size of glass mentioned is recommended as the maximum that should be used, particularly if wired.)

Roofing contractor shall flash all skylight curbs to the high inside point.

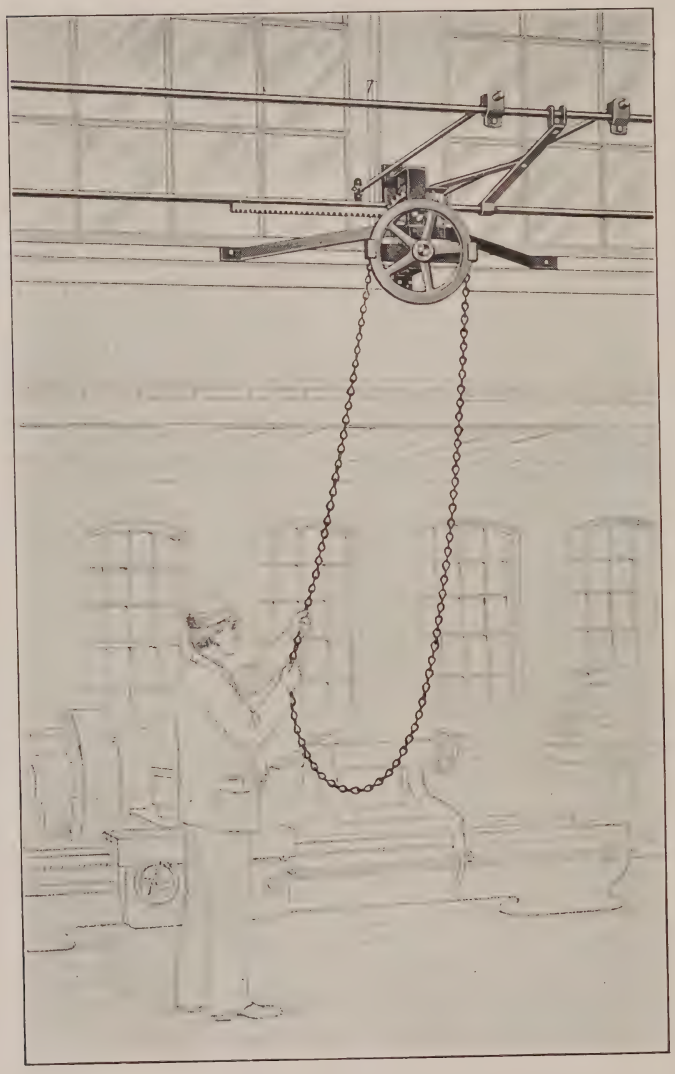
Attention is called to the question of framing for hipped skylights over openings that exceed 10 feet in width. A special steel frame results in a more permanent installation and eliminates danger from destructive winds and inside drafts loosening the skylight, necessitating early repairs and causing excessive glass crackage.

Good practice has taught that it is advisable that supports not exceed six (6'-0") feet apart, the maximum glass length that should be used.

A FEW "ANTI-PLUVIUS" INSTALLATIONS

Adeline Sugar Refining Co. ..... Adeline, La.
Aeolian Co. ..... Garwood, N. J.
Aluminum Castings Co. ..... Fairfield, Conn.
American Brass Co. ..... Ansonia, Conn.
American Steel & Wire Co. ..... Worcester, Mass.
American Optical Co. ..... Southbridge, Mass.
American Stove Co. ..... Cleveland, Ohio
Baird Machine Co. ..... Bridgeport, Conn.
Beaver Co. ..... Buffalo, N. Y.
Bellevue Hospital ..... New York, N. Y.
B. & O. R. R. Co. ..... Chicago, Ill.
B. & O. R. R. Co. ..... Baltimore, Md.
Birmingham Iron Foundry ..... Derby, Conn.
Blake & Johnson Co. ..... Waterville, Conn.
Boston Elevated R. R. Co. ..... Boston, Mass.
Boston Elevated R. R. Co. ..... East Boston, Mass.
Boston Elevated R. R. Co. ..... Coolidge Corner, Mass.
Boston & Albany R. R. Co. ..... Springfield, Mass.
Boston & Albany R. R. Freight House ..... Westboro, Mass.
Bosch Magneto Co. ..... Springfield, Mass.
Bottlers & Mfgs. Supply Co. ..... Astoria, L. I., N. Y.
Bridgeport Hospital ..... Bridgeport, Conn.
Bullard Machine Tool Co. ..... Bridgeport, Conn.
Cass Avenue High School ..... Detroit, Mich.
Chelsea Savings Bank ..... Norwich, Conn.
Chase Rolling Mills ..... Waterbury, Conn.
Chicago City Ry. Co. ..... Chicago, Ill.
City National Bank ..... Bridgeport, Conn.
Connecticut Co. ..... Bridgeport, Conn.
Connecticut State Reformatory ..... Cheshire, Conn.
Converse Art Gallery ..... Norwich, Conn.
C. R. R. of N. J. Ferry House ..... New York, N. Y.
C. R. R. of N. J. ..... Ashley, Penn.
Detroit United Rys. ..... Detroit, Mich.
Defiance Machine Co. ..... Defiance, Ohio
Dexter Folder Co. ..... Pearl River, N. Y.
D. L. & W. R. R. Co. ..... Jersey City, N. J.
D. L. & W. R. R. Co. ..... Hoboken, N. J.
D. L. & W. R. R. Co. ..... Scranton, Penn.
Doe Run Lead Co. ..... Flat River, Mo.
Equitable Arcade ..... Columbia, S. C.
Farrell Foundry & Machine Co. ..... Ansonia, Conn.
Federal Sugar Refining Co. ..... Yonkers, N. Y.
Flagg, Ernest ..... New York, N. Y.
Fifth Avenue Building ..... New York, N. Y.
Forstmann & Huffmann ..... Passaic, N. J.
Forest Park Animal House ..... Springfield, Mass.
French Mfg. Co. ..... Waterbury, Conn.
Hendey Machine Co. ..... Torrington, Conn.
Hendricks Bros. ..... Soho, N. J.
International Silver Co. ..... Bridgeport, Conn.
Ingersoll Rand Co. ..... Philipsburg, N. J.
International Harvester Co. ..... Milwaukee, Wis.
Irving Avenue Hospital ..... Syracuse, N. Y.
Isaqueena Mills ..... Central S. C.
Kraus & Co. ..... Memphis, Tenn.
Ledbetter & Mundt Co. ..... Austin, Texas
Long Island Rd. Co. ..... Brooklyn, N. Y.
Market House ..... Toledo, Ohio

Masilion Bridge & Structural Co. ..... Connelsville, Penn.
Masonic Temple ..... Greenville, S. C.
Mt. Hood Ry. & Pr. Co. ..... Portland, Ore.
Murphy Varnish Works ..... Newark, N. J.
New Haven County Court House ..... New Haven, Conn.
New Jersey State Armory ..... Elizabeth, N. J.
New York City Ry. ..... New York, N. Y.
N. Y. C. & H. R. R. R. Co. ..... Rochester, N. Y.
N. Y. C. & H. R. R. R. Co. ..... White Plains, N. Y.
Oklahoma Gas & Electric Co. ..... Oklahoma, Okla.
Oneida Ry. Co. ..... Syracuse, N. Y.
Oxweld Acetylene Co. ..... Newark, N. J.
Packard Motor Car Co. ..... Detroit, Mich.
Peoples Savings Bank ..... Bridgeport, Conn.
Phosphate Mining Co. ..... Nichols, Fla.
Pierce-Arrow Motor Co. ..... Buffalo, N. Y.
Pittsburgh Tool, Steel & Wire Co. ..... Monaca, Penn.
Poli's Theatre ..... Bridgeport, Conn.
Pond Machine Tool Co. ..... Plainfield, N. J.
Public Service Ry. Co. ..... Hoboken, N. J.
Public Service Ry. Co. ..... Jersey City, N. J.
Public Service Ry. Co. ..... Nutley, N. J.
Public Service Ry. Co. ..... South Orange, N. J.
Press Building ..... Cleveland, Ohio
Purdue University ..... Lafayette, Ind.
Quick Meal Stove Co. ..... St. Louis, Mo.
Ralston Steel Car Co. ..... Columbus, Ohio
Roeblings, John A. & Sons Co. ..... Trenton, N. J.
Sanford Building ..... Bridgeport, Conn.
Scovill Mfg. Co. ..... Waterbury, Conn.
Schenectady Illuminating Co. ..... Schenectady, N. Y.
Sioux City Service Co. ..... Sioux City, Iowa
Southern Ry. Co. ..... Atlanta, Ga.
Stratfield Hotel ..... Bridgeport, Conn.
Starin & Persky Office Bldg. ..... New Haven, Conn.
Stanley Works ..... New Britain, Conn.
St. Joseph Lead Co. ..... Bonne Terre, Mo.
Textile Machine Works ..... Reading, Penn.
Union Fabric Co. ..... Derby, Conn.
United Cork Corp. ..... Washington, D. C.
Union Bldg. ..... Syracuse, N. Y.
Union Drawn Steel Co. ..... Beaver Falls, Penn.
United States Post Office ..... New Haven, Conn.
United States Post Office ..... Connersville, Ind.
United States Post Office ..... Manchester, N. H.
United States Post Office ..... Portsmouth, Va.
United States Post Office ..... Beloit, Wis.
United States Government ..... Fort Hamilton, N. Y.
Utica Knitting Mills ..... Utica, N. Y.
Vulcan Iron Works ..... New Britain, Conn.
Vulcan Iron Works ..... Wilkesbarre, Penn.
Warner Bros. Co. ..... Bridgeport, Conn.
Waterbury Mfg. Co. ..... Waterbury, Conn.
West Technical High School ..... Cleveland, Ohio
Western Block Co. ..... Lockport, N. Y.
Winchester Repeating Arms Co. ..... New Haven, Conn.
Woolson Spice Co. ..... Toledo, Ohio
York Mfg. Co. ..... York, Penn.



SASH CONTROL

Both the architect and manager of industrial plants have reason to be interested in securing an efficient means of opening and closing the long lines of windows which are found in the side walls, monitor, and sawtooth roofs of almost every manufacturing building—the architect because the use of a sash-opening device affects his designs—the manager because sash control means better working conditions.

Good ventilation in a manufacturing plant repays more than it costs in increased efficiency of the workmen.

Continuous, efficient, and regulated ventilation can be secured only by the proper manipulation of lines of windows. From these two points arise the need of mechanical devices for controlling the opening and closing of long lines of windows. The care of a window cannot be left to the individual for he usually neglects it altogether, or opens it when it should not be opened, admitting undesirable drafts, dust or smoke, often annoying his fellow workmen or causing damage to machines or stock. Some windows are located at a height that prevents operation by an individual.

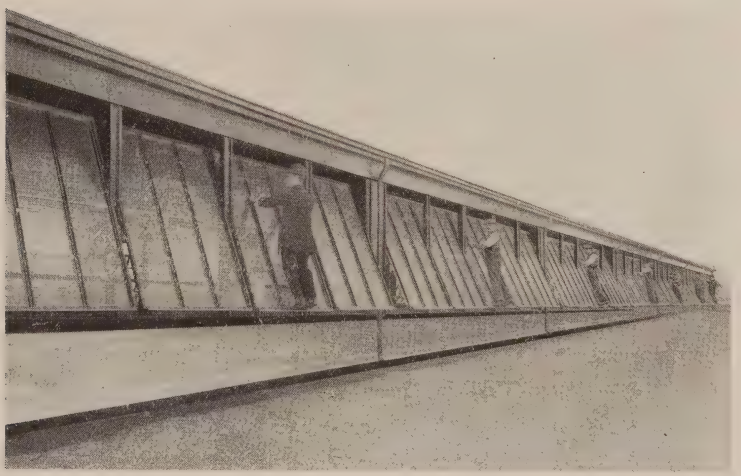
Windows pivoted at the sides, or at top and bottom, give a larger opening than those hinged at the top. The air flowing inward and outward is better distributed and it insures more successful ventilation.

It is obvious that to properly ventilate a large building with sashes too high to be reached conveniently from the floor requires a sash operating device that will control any reasonable number of sashes at the same time, open them all at the same moment, hold them in place while open, and lock them automatically

"STRAIGHT-PUSH" SASH OPERATOR CONTROLLING SASHES PIVOTED AT SIDES

Malleable Iron Fittings Company. Foundry Building
Branford, Connecticut

when closed. The operating device must be substantially made with few working joints that will not break easily, and is most successful if with it the greatest power is exerted at the start. The "Straight-Push" Sash Operator is very strong, with simple, durable joints, and is as nearly as possible foolproof. It will control any reasonable number of metallic or wood sashes and open them all at the same moment with equally distributed power. The apparatus must meet the service conditions found in industrial buildings. It must stand hard usage and continue to be effective, even if neglected. Each window, whether near the operator or at a distant point, must work simultaneously and with equal power, which must be applied as a straight push to open, and a pull to close, without torsion. The "Straight-Push" Sash Operator is adapted to all kinds of sash, pivoted sides, or top and bottom, or hinged at the top, side, or bottom.



"STRAIGHT-PUSH" SASH OPERATOR LIFTS SEVEN MEN
Line of Sash Under Control 150 Feet
Malleable Iron Fittings Company, Branford, Connecticut

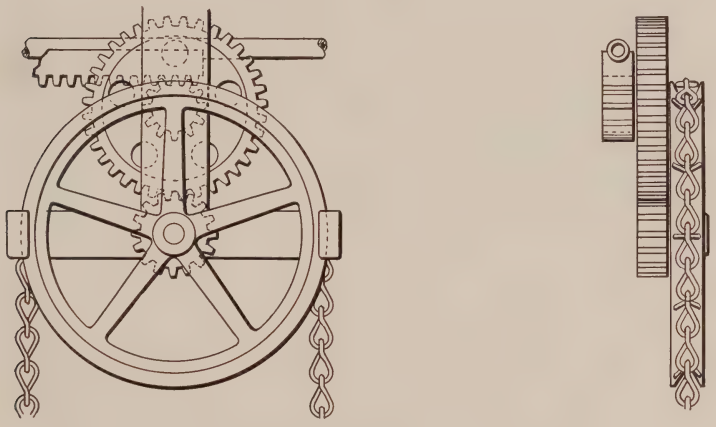
"STRAIGHT-PUSH" SASH OPERATOR OPENING SASH SUPPORTING MEN, ILLUSTRATING POWER BEHIND THE OPERATOR

Pivoted Top and Bottom Sash in Monitor Controlled With Same Type of Operator
The Billings & Spencer Co., Dividend, Connecticut

FORD, BUCK & SHELDON
Engineers,
Hartford, Conn.

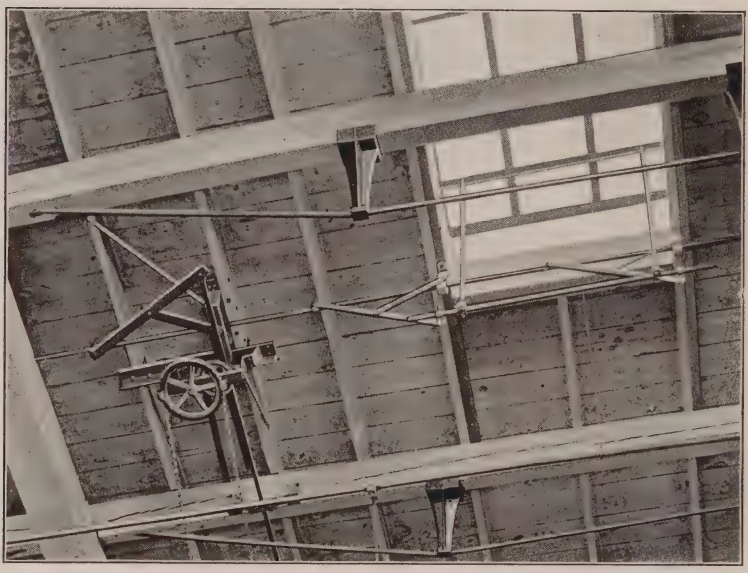
"STRAIGHT-PUSH" SASH OPERATOR

The success of the "Straight-Push" Sash Operator is due to its certain control of long lines of windows, and serviceableness under shop conditions. Combining the most approved design, the best materials which can be put into a device of this kind, and requiring the least power because of the spur gear mechanism, the "Straight-Push" Sash Operator is the most satisfactory device on the market for manipulating many windows at once.



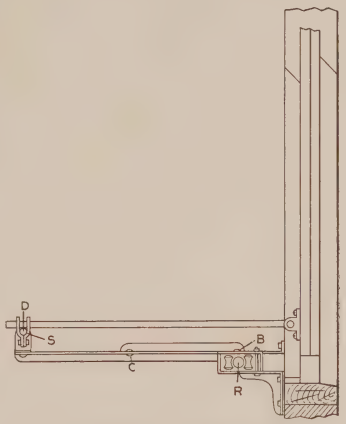
TYPE "00" OPERATING STATION

This operator is controlled by cut gear, pinions and steel rack which moves backward and forward a line of ¾-inch pipe dowel-pin connected. The shaft passes between malleable iron rolls carried on brass pins which are held in supporting brackets placed on an average of 6 feet apart, and fastened to mullions, steel or wood uprights, or trusses. This combination prevents the rolls sticking or rusting together. Each sash is given a direct push or pull, and because of the efficiency of the mechanism one man can operate any reasonable number of sashes. To the pipe shaft is secured a series



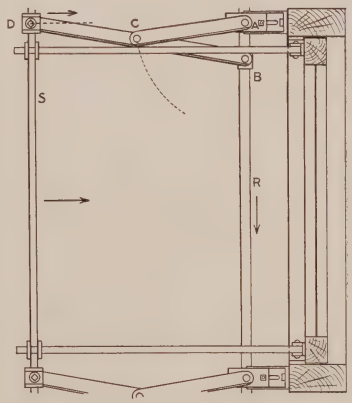
"STRAIGHT-PUSH" SASH OPERATOR OPERATING SKYLIGHTS IN SERIES
United Illuminating Company, Bridgeport, Connecticut

of levers, one set for each sash. The levers have a scissors-like action and to each set are attached two arms secured to each side of the sash. The flat working joints have phosphor bronze washers between to minimize friction and prevent rusting together. The action for opening the window is a direct thrust with leverage force greatest at the start. The return movement is a pull, the levers forming a toggle action which insures a tightly closed and securely locked sash.



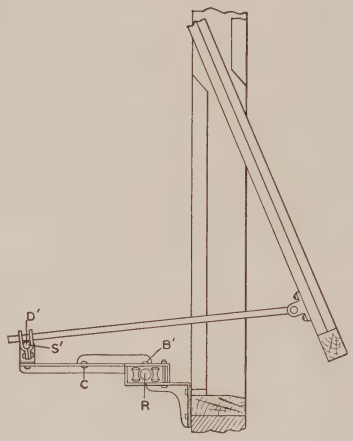
ELEVATION—CLOSED
Fig. 1

Power is applied to a sheave wheel by pulling on the chain. Revolving this wheel revolves also a pinion on the same shaft, this pinion being in mesh with the gear wheel in order to reduce the speed. On the same shaft with this gear is another pinion which of course makes the same number of revolutions as the large gear but has a much lower peripheral speed because it is of much smaller diameter. In this way, the high speed of the sheave wheel is reduced to that of the slowly moving pin-



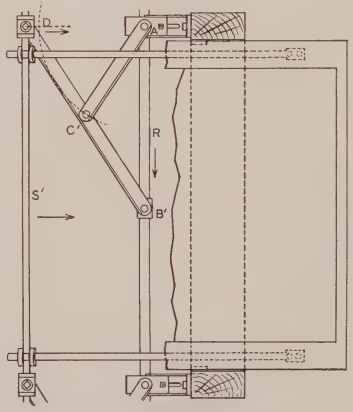
PLAN—CLOSED
Fig. 2

ion which is in mesh with a straight rack to which is secured the moving pipe shaft extending to the most distant window to be operated. Parallel to this pipe shaft is another smaller shaft of one-half inch pipe which ties all arms together and moves with them toward and away from the windows, but it does not move in the direction of its length.



ELEVATION—PARTIALLY OPEN
Fig. 3

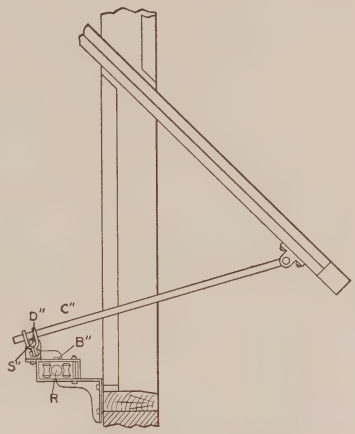
The arms, made of one-half inch solid rod, are secured to hinges located on the sash and at the other end fixed to the one-half inch pipe shaft which is supported by chairs riveted to the levers. There are two of these rods to each sash; the chair and arm connection act on a swivel which permits the rod to follow the inclination of the sash.



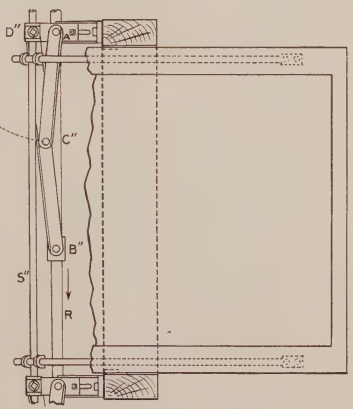
PLAN—PARTIALLY OPEN
Fig. 4

The sashes are operated as follows: The power applied to the sheave wheel is transmitted to the rack through the pinions and gears; movement of the rack also moves the long pipe shaft which through the levers moves the operating arms toward and away from the windows, and these arms push or pull the sash.

Referring to the accompanying illustrations, which show the sash closed, partially open, and wide open,—moving the rod R in the direction of the arrow moves B, Fig. 2, to B′, Fig. 4, and then to B″, Fig. 6, which causes C to move in an arc, having a radius equal to the length of the short lever, to C′, Fig. 4, and C″, Fig. 6. This short lever is pinned or jointed at A. Movement of the levers draws D in to D′, Fig. 3 and 4, and to D″, Figs. 5 and 6, pulling the spool and the shaft S toward the shaft R, and as the spool is fastened to the operating sash rods, drawing the spool toward R pushes the window open, as shown in Fig. 5 and 6. This movement of D to D′ and to D″ is shown also in Figs. 1, 3, and 5.

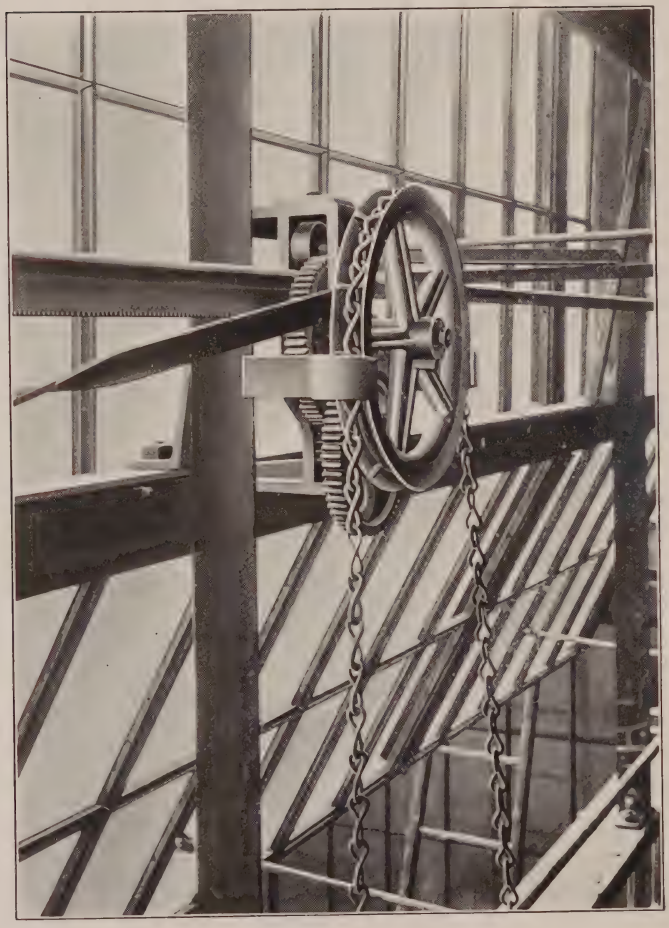


ELEVATION—WIDE OPEN
Fig. 5



PLAN—WIDE OPEN
Fig. 6

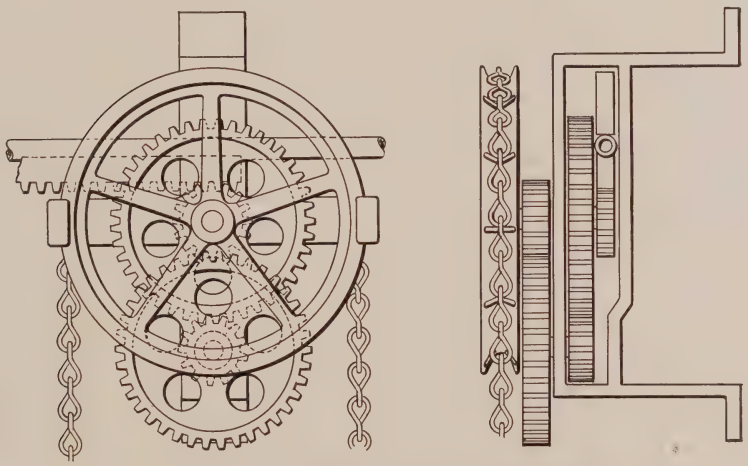
The device for operating the rack is very powerful, utilizing the principle which applied to a hoist enables a man to lift great loads with little effort. In many cases the loads are several times his own weight. With the hoist mechanism the comparatively slight effort of the man applied through a



HIGH GEARED POWER STATION
For Very Heavy Sashes and for Sashes Hinged at the Top to Swing Outward
Offsets Load and Does Away with Use of Counterweights

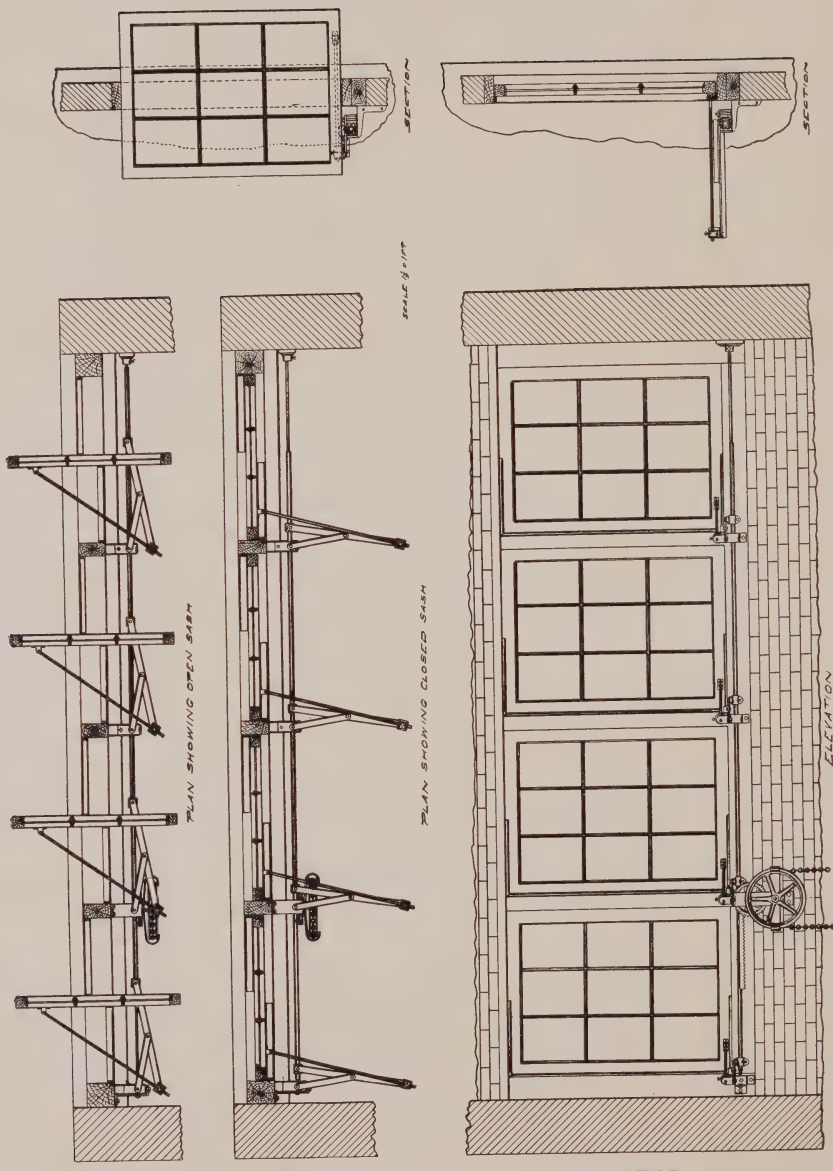
considerable distance lifts the load a short distance; the pull on the chain of the Straight Push Sash Operator is transmitted through a train of spur gears and the man's pull opens and closes lines of sash 100, 150 and 200 feet in length, easily and quickly.

One of the advantages of the Straight Push Sash Control is the effectiveness of the pull—the train of gears is of such high efficiency that very little power is lost in friction. Another advantage is the direct result of the straight push or pull, no power is lost in torsion. There is no twisting to cause resistance, all effort goes into operating the sash.

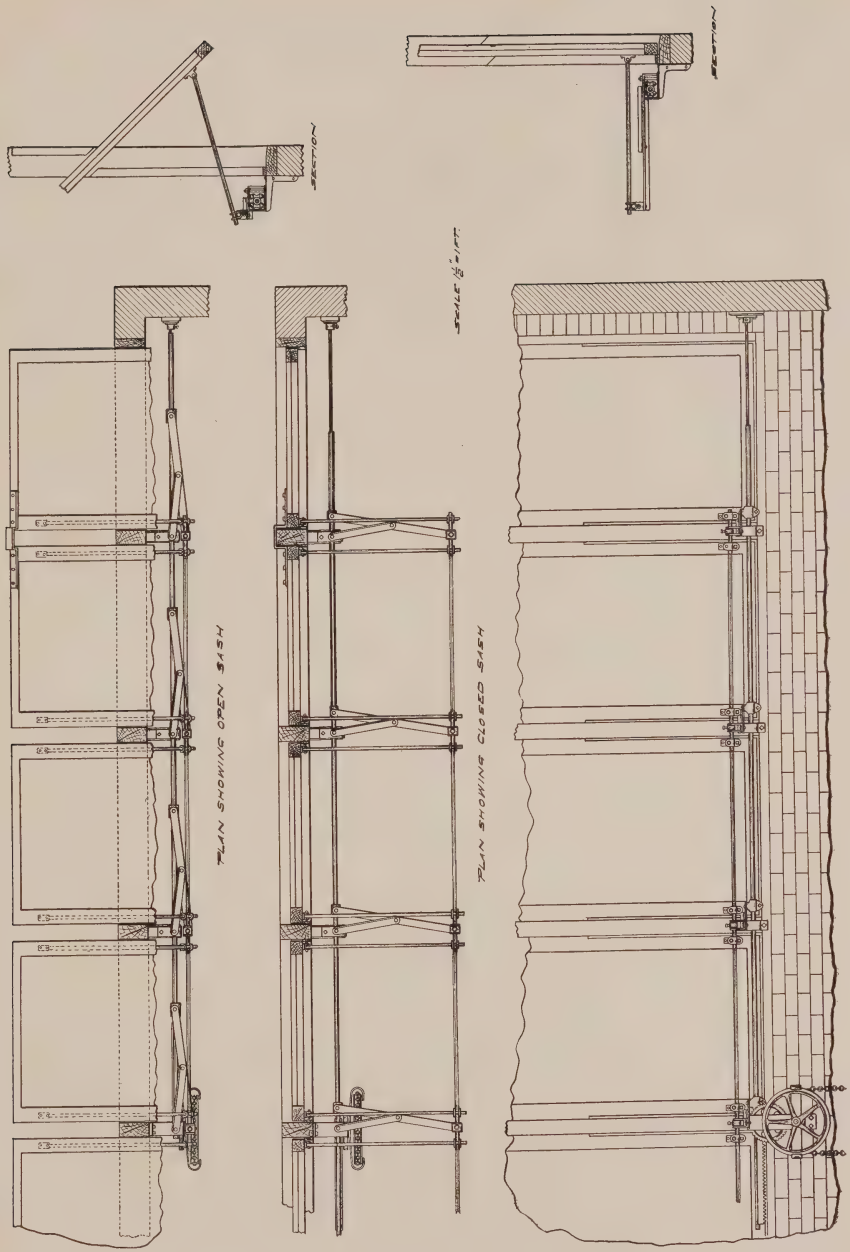


TYPE "A" OPERATING MECHANISM

A much higher geared power station is used when the sashes hinge at the top to swing outward to offset the load or weight on the operator. Roller-bearing idlers are used for bringing operating chains to desirable places for operation where a straight drop is not obtainable.



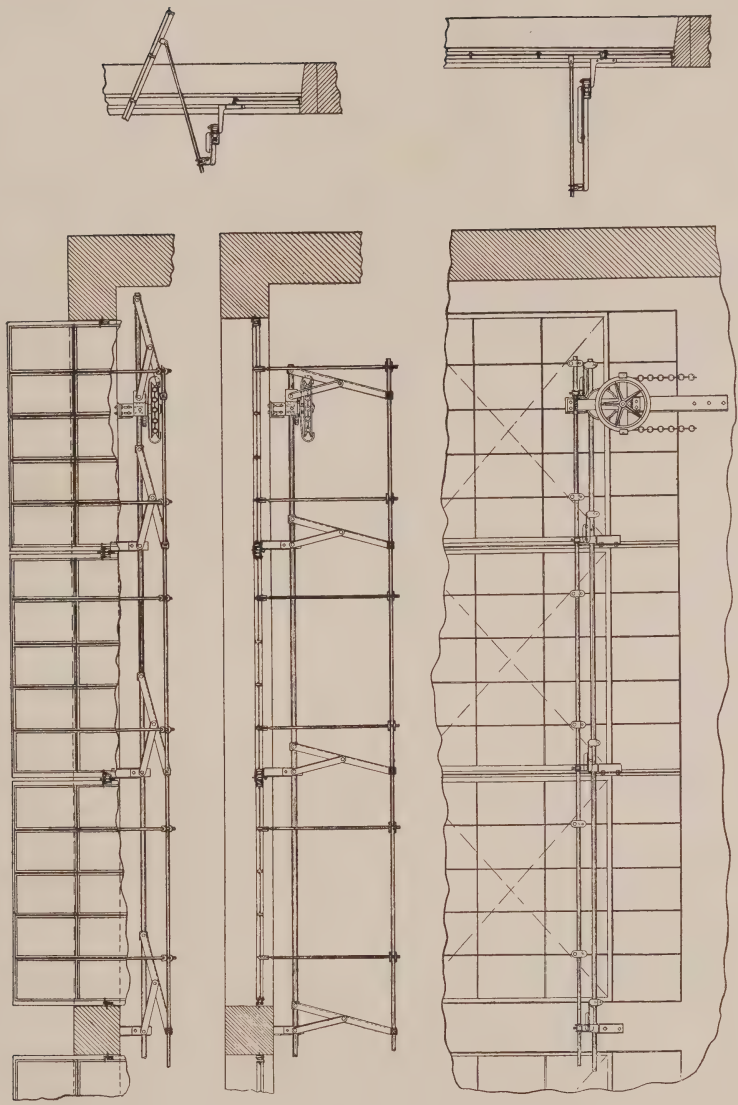
THE "STRAIGHT-PUSH" SASH OPERATOR
Sash Pivoted at Top and Bottom



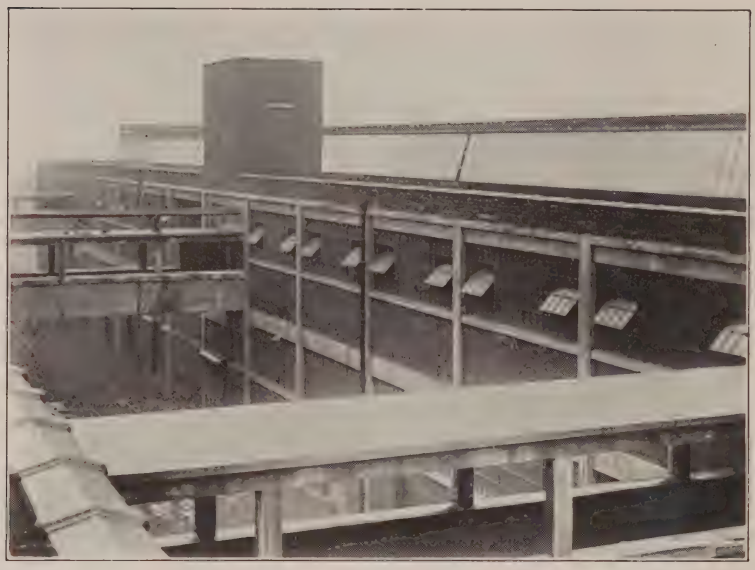
THE "STRAIGHT-PUSH" SASH OPERATOR
Sash Pivoted at Sides

"STRAIGHT-PUSH" SASH OPERATOR CONTROLLING UNITED CONTINUOUS SASH
Ford Motor Company, Detroit, Michigan

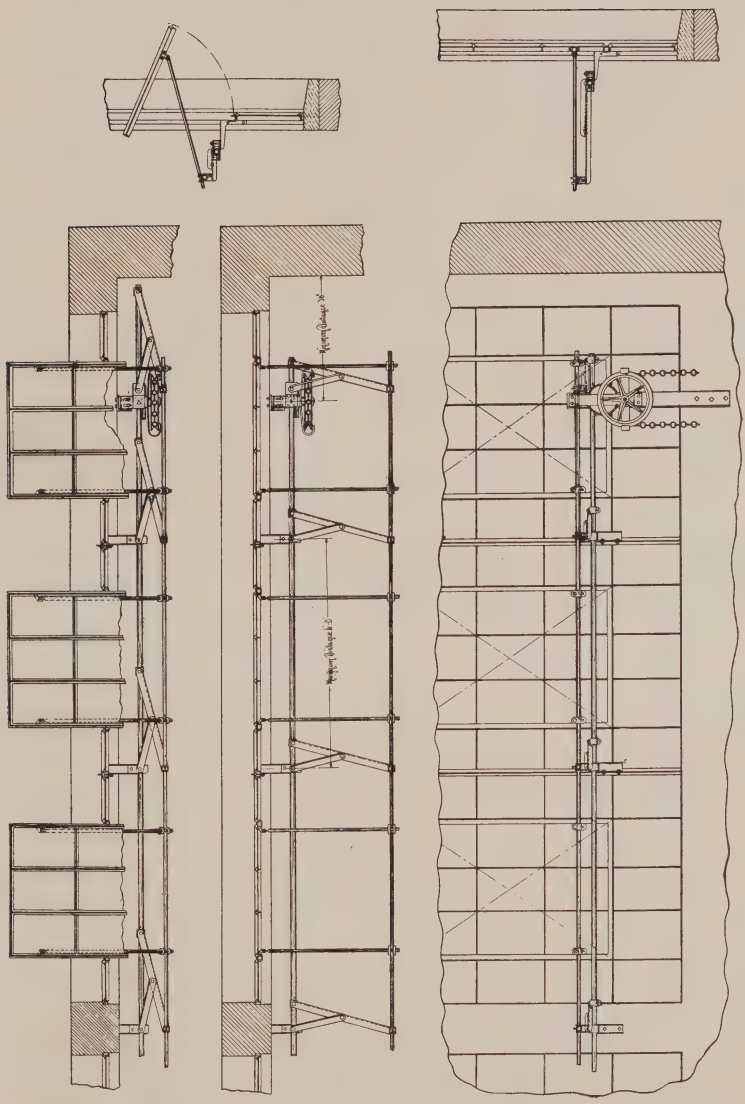
W. E. Wood,
Engineer and Contractor,
Detroit, Mich



APPLICATION TO UNITED STEEL SASH
Pivoted Type



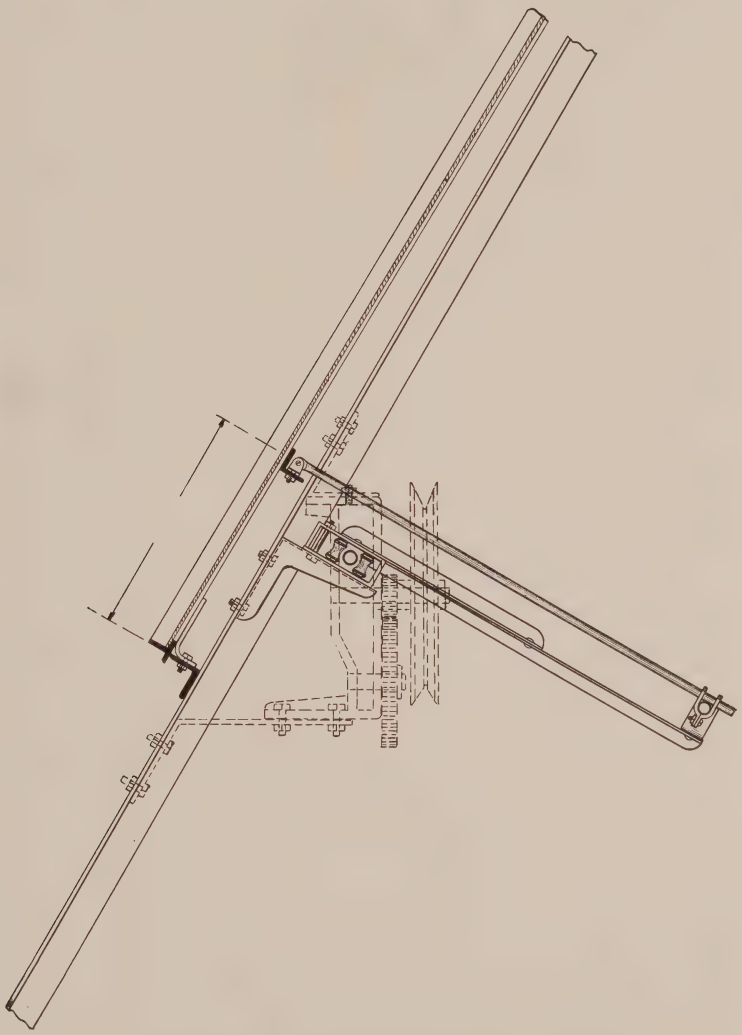
"STRAIGHT-PUSH" SASH OPERATOR
Applied to Fenestra Continuous Sash. The Standard Oil Co., Cleveland, Ohio



APPLICATION TO DETROIT-FENESTRA STEEL SASH
Pivoted Type

GOOD VENTILATION AND LIGHTING

"Straight-Push" Sash Operator Controlling "Fenestra" Steel Sash. The Packard Motor Car Company



DOTTED LINES SHOW METHOD OF FIXING SPECIAL OPERATING POWER TO STEELWORK FOR CONTROLLING SAW-TOOTH SASH
Hinged at Top

SPECIFICATION
"STRAIGHT-PUSH" SASH OPERATOR

Where mechanical sash operating device is required for controlling groups of sash, furnish and erect, "Straight-Push" sash operator manufactured by The G. Drouvé Company, Bridgeport, Conn.

It is recommended that lines be drawn through the sash on the elevations designating the number to be operated with an independent operating station. This will facilitate estimating and clearly show the requirements. The "Straight-Push" sash operator is figured on the basis of per linear foot, one operating station being included with every one hundred feet. Operating stations more frequent are extra. A standard price is maintained which is generally known and this serves as a protection in specifying this device.

We recommend the control of pivoted sash in lines of 100 to 150 linear feet, more *can* be handled and many longer run installations are in service today, but conditions cannot always be depended upon and experience and investigation justifies the recommendation. The use of steel continuous sash has developed a larger demand upon an operating mechanism and 50 to 100 foot runs will stand service conditions longer and hold up under strains, both continual and occasional, better than runs of 200 or more linear feet. The smaller runs also do away with the use of counter-weights and the attending danger in case of failure. These are seriously objected to by factory managers and have been done away with by our type "A" operating station.

A FEW "STRAIGHT-PUSH" SASH OPERATOR INSTALLATIONS

American Agricultural Chemical Co. . .Rockford (Cleveland), Ohio
American Motor Castings Company .....Detroit, Mich.
American Radiator Co. .....Litchfield, Ill.
American Steel & Wire Co. .....Birmingham, Ala.
American Stove Company .....St. Louis, Mo.
Ansonia Brass & Copper Co. .....Ansonia, Conn.
Astoria Light Heat & Power Co. .....Astoria, L. I., N. Y.
Baird Machine Company .....Bridgeport, Conn.
Bellevue Hospital .....New York, N. Y.
The Best Mfg. Co. .....Oakmont, Penn.
Bethlehem Steel Co. .....South Bethlehem, Penn.
The Billings & Spencer Co. .....Dividend, Conn.
Boston & Albany R. R. Co. .....Springfield and East Boston, Mass.
Boston Elevated Railway Co. .....Boston, Mass.
Brown, Lipe & Chapin .....Syracuse, N. Y.
Bryant Electric Co. .....Bridgeport, Conn.
Cadillac Motor Car Co. .....Detroit, Mich.
Canadian-Rand Company .....Sherbrook, Ontario, Canada
Capitol City Traction Co. .....Washington, D. C.
Central R. R. of New Jersey .....Ashley, Penn.
Chase Rolling Mills Co. .....Waterbury, Conn.
Chicago & Northwestern R. R. Co. .....Chicago, Ill.
Colby Motor Co. .....Mason City, Iowa
Commonwealth Edison Co. .....Chicago, Illinois
Continental Motor Car Co. .....Detroit, Mich.
Deane Steam Pump Co. .....Holyoke, Mass.
D., L. & W. R. R. Co. .....Scranton, Penn.
Detroit Steel Products Co. .....Detroit, Mich.
Dodge Brothers .....Detroit, Mich.
The E. M. F. Co. (Studebaker) .....Detroit, Mich.
Elmore Manufacturing Co. .....Clyde, Ohio
Enameled Metals Company .....Etna, Penn.
Fairview Pumping Station .....Detroit, Mich.
Favorite Stove & Range Co. .....Piqua, Ohio
Fisk Rubber Company .....Chicopee Falls, Mass.
Ford Motor Co. .....Detroit, Mich.
Ford Plate & Window Glass Co. .....Toledo, Ohio
Forstmann & Huffmann Co. .....Passaic, N. J.
Fulton Iron Works .....St. Louis, Mo.
General Electric Company .....West Lynn, Mass.
General Fire Extinguisher Co. .....Warren, Ohio
General Motors Co. .....Detroit, Mich.
Gifford-Wood Company .....Hudson, N. Y.
Globe Malleable Iron Co. .....Syracuse, N. Y.
The Gilbert & Barker Mfg. Co. .....Springfield, Mass.
Goldfield Mining & Transportation Co. .....Goldfield, Nevada
Greenfield Electric Light Co. .....Greenfield, Mass.
The P. H. Hanes Mills Company .....Winston-Salem, N. C.
The Harlan & Hollingsworth Corp .....Wilmington, Dela.
Hartford Carpet Corporation .....Thompsonville, Conn.
The Haskell-Barker Car Co. .....Michigan City, Indiana
Indiana & Michigan Electric Co. .....South Bend, Indiana
Indiana Steel Company .....Gary, Indiana
International Harvester Co. .....Milwaukee, Wis.
International Harvester Co., Tractor Plant .....Chicago, Ill.
International Silver Company .....Meriden, Conn.
Johnson Biscuit Company .....Sioux City, Iowa
Johnston Harvester Company .....Batavia, N. Y.
Lake Shore & Michigan Southern Ry. .....Ashtabula, Ohio

The L. S. & M. S. Ry. Co. ..... Ashtabula Harbor, Ohio
Locomobile Company of America ..... Bridgeport, Conn.
The Long Mfg. Co. ..... Detroit, Mich.
Los Angeles Gas & Electric Co. ..... Los Angeles, Cal.
Louisville & Nashville R. R. Co. ..... Boyles, Ala.
Lozier Motor Co. ..... Detroit, Mich.
Marquette Motor Co. ..... Saginaw, Mich.
Mayo Mills ..... Mayoden, N. C.
Mengel Box Co. ..... Jersey City, N. J., and Louisville, Ky.
Mississippi Glass Co. ..... St. Louis, Mo.
Montreal Steel Works ..... Montreal, Canada
N. Y. C. & H. R. R. R. Co. ..... North White Plains, N. Y.
N. Y., N. H. & H. R. R. Co. ..... New Haven, Conn.
N. Y., P. & N. Ry. Co. (Pennsylvania Rd.) ..... Cape Charles, Va.
New York Radiator Co. ..... Utica, N. Y.
National Supply Co. ..... Toledo, Ohio
Northway Motor & Mfg. Co. ..... Detroit, Mich.
Ohio Steel Co. ..... Youngstown, Ohio
Oldsmobile Co. ..... Lansing, Mich.
Omaha & Council Bluffs St. Ry. Co. ..... Omaha, Nebr.
Otis Elevator Co. ..... Quincy, Ill.
Owosso Mfg. Co. ..... Owosso, Mich.
Oxford Linen Mills ..... No. Brookfield, Mass.
Packard Motor Car Co. ..... Detroit, Mich.
Pacific Gas & Electric Co. ..... Oakland, Cal.
Palmer, Dock (N. Y., N. H. & H. R. R.) ..... Brooklyn, N. Y.
Peck, Stowe & Wilcox Co. ..... Southington, Conn.
Pennsylvania Salt Mfg. Co. ..... Wyandotte, Mich.
Pressed Steel Car Co. ..... McKees Rocks, Penn.
Public Bath House ..... Coney Island, N. Y.
Public Service Ry. Co. ..... Hoboken, N. Y.
Quincy Gas & Electric Co. ..... Quincy, Ill.
Rapid Motor Vehicle Co. ..... Pontiac, Mich.
Remington Typewriter Co. ..... Ilion, N. Y.
Ridgewood Pumping Station ..... Brooklyn, N. Y.
Rockford Drop Forge Co. ..... Rockford, Ill.
M. Rumely Company ..... Billings, Mont.
Scovill Mfg. Co. ..... Waterbury, Conn.
Seaboard Air Line Ry. Co. ..... Savannah, Ga.
Shore Line Railway Co. ..... Saybrook Junction, Conn.
Singer Mfg. Co. ..... Elizabethport, N. J., and South Bend, Ind.
The H. B. Smith Co. ..... Westfield, Mass.
Solvay Process Co. ..... Syracuse, N. Y., and Detroit, Mich.
Southern California Edison Co. ..... Ostend, Cal.
Southern Railway Co. ..... Spencer, N. C.
Standard Oil Co. ..... Cleveland, Ohio
Standard Oil Co. ..... Richmond, Cal.
Standard Oil Cloth Co. ..... Athenia, N. J.
Standard Oil Cloth Co. ..... Akron, Ohio
Texas Company ..... Bayonne, N. J.
Trumbull Electric Mfg. Co. ..... Plainville, Conn.
Union Drawn Steel Co. ..... Beaver Falls, Penn.
United Illuminating Co. ..... Bridgeport, Conn.
United States Cartridge Co. ..... Perth Amboy, N. J.
Vollrath Mfg. Co. ..... Sheboygan, Wis.
Wayne Knitting Mills ..... Fort Wayne, Ind.
Wiedeman Silk Mills ..... Paterson, N. J.
Western Block Co. ..... Lockport, N. Y.
Western Steel Car & Foundry Co. ..... Hegewich, Ill.
West Technical High School ..... Cleveland, Ohio
Winchester Repeating Arms Co. ..... New Haven, Conn.

The Lovell Window Operator

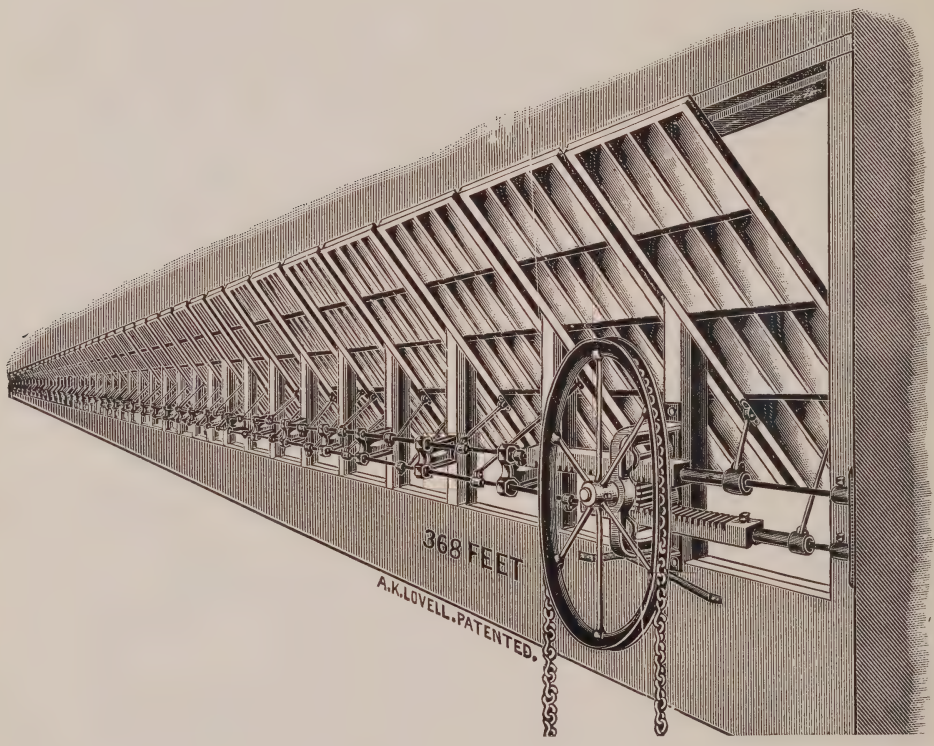
The pioneer "Push and Pull" type of window operator for controlling pivoted or hinged sash in groups is the "Lovell." It has been on the market since 1902 and is used extensively in all classes of buildings throughout the United States. The accompanying illustrations show the general principle of operation. Recently improvements have been made in detail parts; the main operator shafts have been increased from one-half-inch to one-inch pipe and the arms from one-half-inch pipe to five-eighths-inch solid rod; connections have been strengthened, and the operator now represents all that experience under the most difficult conditions can teach.

For each window there are provided two arms which work uniformly, the shaft being controlled by double rack and pinion from one station which may be established anywhere along the line. The sliding shafts which operate in opposite directions are supported by extension brackets secured to mullions. These brackets have anti-friction rollers which act as guides for the shafts. All windows open and close simultaneously, an equal application of power being applied at every sash.

For operation from the floor a chain runs over a wheel on the shaft, causing a rolling motion, which controls the pinion. Universal joints of bronze to prevent rusting and binding make the connection between the moving shaft and the sash. The arms work with the movement of the shaft. The arms are connected to the operating shaft with adjustable open couplings.

The construction of this operator is simple, and it is easy to place, and when the sash is properly installed

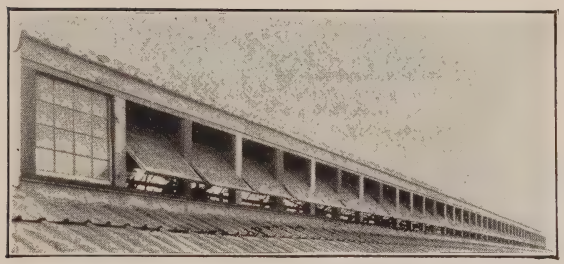
insures an economical and satisfactory working arrangement. This device is largely specified and usually by those having had experience with it. 500 feet have

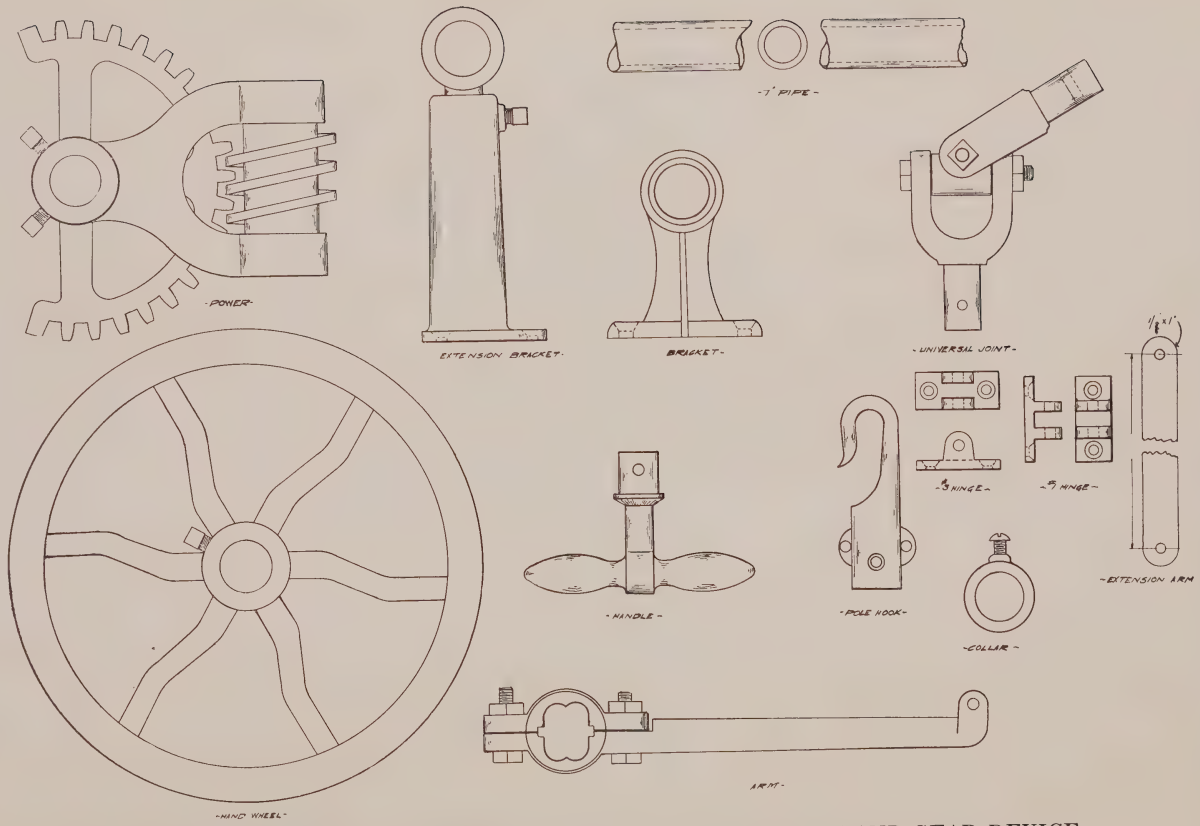


been operated in one line, and there are a number of installations of 200 feet that have been in service over seven years without repairs and with no attention other than oiling.

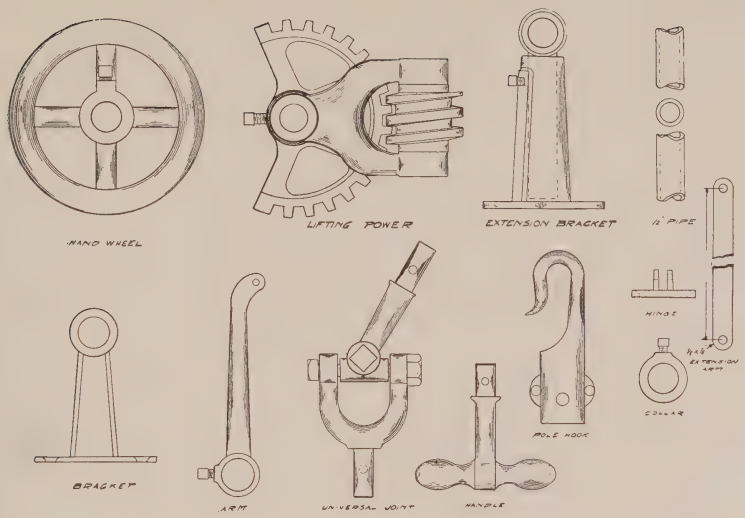
A standard price per linear foot which includes one operating station to every 100 feet has been established so that a specification is protected.

Additional information and blue prints furnished on request—also estimates.





VARIOUS PARTS (CASTINGS) THAT MAKE UP THE WORM-AND-GEAR DEVICE
ONE INCH SIZE



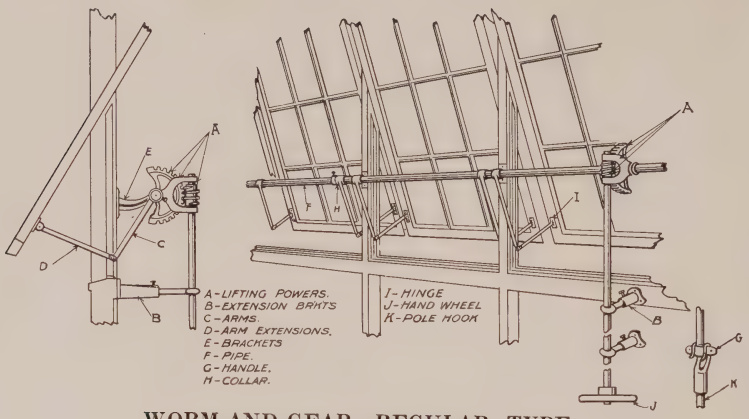
ONE-HALF INCH SIZE

DROUVÉ TORSION DEVICE

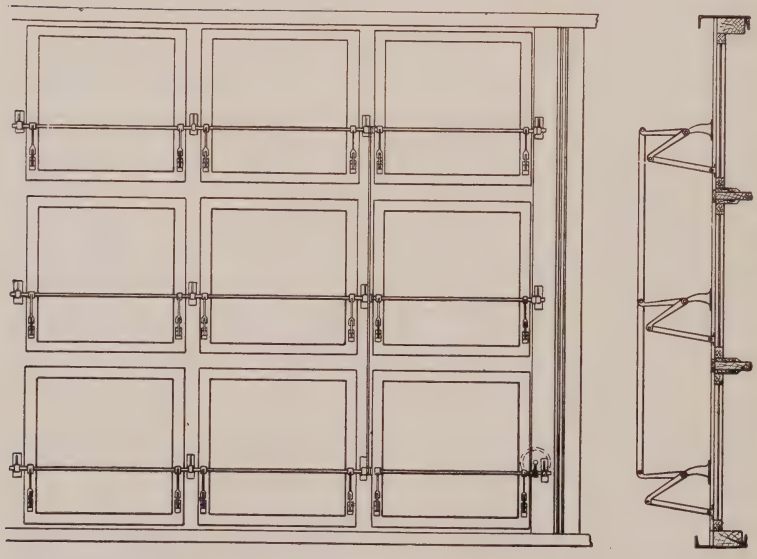
For operating small groups of sashes where a cheap arrangement is desired and the sashes are easily accessible for repairs, adjustments, and oiling, as in greenhouse work, the worm-and-gear device often serves the purpose. We make this device in the half-inch and inch size of which the various parts are shown in the accompanying illustrations.

The parts are made of cast iron with cut gears, and the number of pieces required for a given installation are dependent upon the conditions. Unless the sashes are very small, two arms should be used on each to insure a uniform handling.

When specifying an operator of this type mention the "Drouvé Torsion Device," and state whether it is to be half-inch or inch. In this way it will be distinguished from the Drouvé "Straight-Push" and "Lovell" types. Although the torsion principle is satisfactory for small groups it is not recommended for long lines of sash which must be held tight at all points.



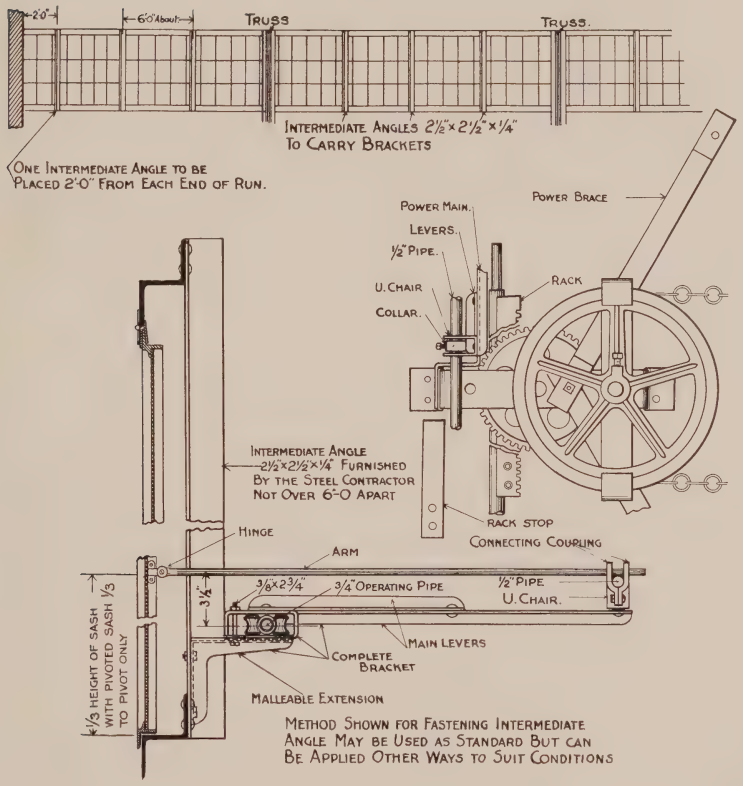
WORM-AND-GEAR—REGULAR TYPE



SHOWING WORM-GEAR METHOD OF OPERATING CEILING LIGHTS FOR POST OFFICES, SCHOOLS, OFFICE BUILDINGS, ETC.

OPERATOR LAYOUT INSTRUCTIONS

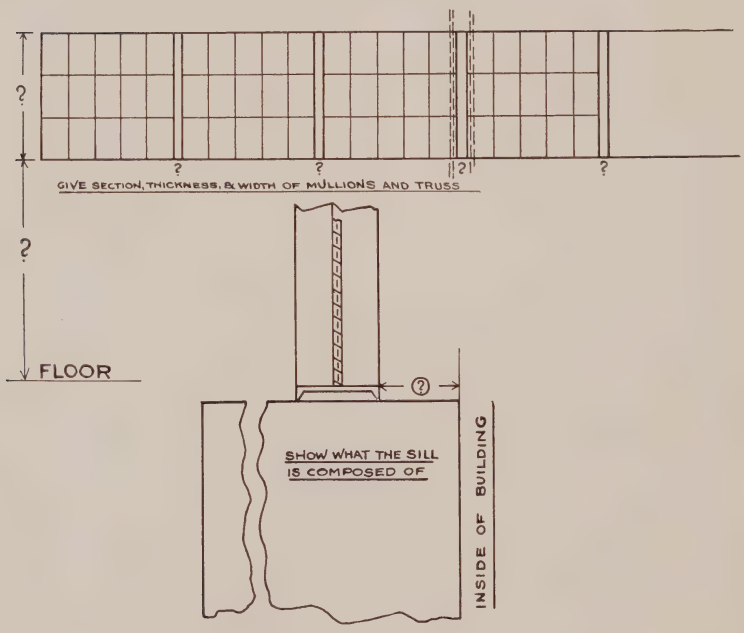
FOR "STRAIGHT-PUSH" SASH OPERATOR



See pages 60, 61, 63 and 65 for plans, cross-sections, and additional details of "Straight-Push" sash operators applied to wood and steel sash.

INFORMATION REQUIRED FOR ESTIMATE

State: Length of run.
Number of sash to be operated.
Size of sash.
Kind — wood or metal.
Pivoted or hinged.
Section — thickness and width of sash, mullions, and truss.
Height from floor.
Position of sash on sill.
Finish at both ends, with dimensions.



Mullions for the support of operating device brackets should not exceed 6′ 0″ on centers if a satisfactory installation under service conditions is to be secured.

This applies to all types of operators